THE

# ELECTRICAL REVIEW.

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## "ELECTRICAL REVIEW."

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THE

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## BUSINESS, SENTIMENT, AND PROTECTION.

IT is often enough asserted that there is no sentiment in business, but everybody knows that the statement is far from true. As a matter of fact, there is a good deal of sentiment in business, and its entire elimination is neither possible nor desirable. At the same time it is to be admitted that a predominance of sentiment is liable to make a business transaction unsatisfactory, and there is accordingly a very general understanding that a matter of business is undertaken for business purposes, as buying and selling are assumed to be intended to lead to the getting of gain. In ordinary transactions between individuals, there is little danger of this principle being forgotten, though there are, every day, instances of magnanimity and self-sacrifice, prompted by sentiment, on the part of a trader, when, perhaps, a transaction has not exactly followed the lines anticipated. Nevertheless, there is no inducement to advertise the existence of the sentiment, and usually the only result is to produce caution in future transactions. Where a collective sentiment can be appealed to, there is greater danger, and, perhaps, of all sentiments the pseudo-patriotic is the most dangerous because the most alluring, and, with a limited horizon, apparently most praiseworthy.

A case in point is found in the speech of the chairman at the annual meeting of the General Electric Co., Ltd., which appears in our "City" columns. Reporting a large increase in business and in gross profits, Mr. Byng intimated that there was one unsatisfactory feature — the loss at the Witton Works of £20,000, mainly due to the carbon factory. "We started our carbon works," said the chairman, "because we were entirely depending upon German manufacturers. This was a dangerous position to be in, both from a business and a patriotic point of view." The danger from the point of view of the General Electric Co.'s business may clearly be left to their own judgment; the danger from the patriotic point of view is of more general interest and requires fuller examination. Mr. Byng says it would be a source of great danger in case of war, because of the need of searchlights on our fighting vessels. What is this danger? Is it the danger that our Navy will be unable to protect our mercantile marine in the transport of supplies? If so, we fear that there are greater dangers than being without carbons. Or is it the danger that we may lack carbons by reason of being at war with the producing country? France also is noted for its carbon manufacture. Is there any immediate danger of a coalition of France and Germany against England?

After revealing this national danger, Mr. Byng proceeded to define the situation in relation to his company's own carbon works. They have cost £60,000 to erect, and a vast number of experiments have been made, resulting in a loss of £20,000, written off in the past year's

accounts. Carbons are now being manufactured equal to, or better than, those made in Germany. And what is the result? The three largest foreign manufacturers have decided to reduce their prices so as to sell at a loss and kill the British industry. Mr. Byng has succeeded in finding some purchasers in Government departments and public bodies who are so far actuated by sentiment as to give their support "in spite of the price regulated by such indicated foreign policy," and with this help and lower prices for raw materials, he hopes to keep his carbon works going until the country awakes from its folly and puts a duty on imported carbons. Replying to questions from a shareholder, Mr. Byng stated "the carbon works will be shut up unless we get Protection." His speech was made with the object of enlightening not only his shareholders but the country at large. As the head of an important electrical organisation it is quite possible that his claim to Protection may go forth as representative of the electrical industry.

In that spirit of inquiry which may be said to be the spirit of the age, let us consider what would be the effect on the industry generally if Mr. Byng's claims to Protection were recognised.

Electricity is utilised for purposes of illumination. There are other methods of illumination with which electricity has to compete. The cheapness with which it can be furnished has an important influence upon its growth. The only item of consumption, outside the boilers, is the carbon, and if the price of carbon be increased, it cannot fail to retard the extension of electric illumination, with a consequent limitation in the manufacture of lamps, dynamos, switches, mains, and a proportionate restriction in the production of current.

We have, for obvious reasons, limited our survey to the effect on the electrical industry of this proposed artificial increase in price in an essential article of consumption, and so far from supporting the claim for Protection, we think it is obvious that the industry, as a whole, will be the gainer by maintaining the present freedom. Needless to say, we should be gratified to know that we were as well able to make carbons as any other nation. And since Mr. Byng says the raw material is cheaper here than in Germany, we must, for the present, decline to believe that the contrary has been definitely demonstrated. It is not only in new industries that factories are sometimes worked at a loss. If, however, the proprietors embark in their undertakings on principles of business without any reference to sentiment, they are better able to determine whether to persevere or to shut up.

We are desirous that our area of inquiry should not be narrowed. We recognise, as we believe all our readers will recognise, that electrical industries will not be improved by dear carbons. We may go further, and recognise that the prospects of any other industry of the country will not be improved by dear light. But we must grant that that does not exhaust Mr. Byng's argument. He says, in effect, your cheap carbons, your cheap electric light, are temporary; when my industry is killed, prices will go up. If we are to accept as accurate Mr. Byng's statement of facts, there would seem no particular reason for foreign manufacturers to have reduced their prices. There are no indications that the General Electric Co.'s factory could supply all the home demands which exist, and, as long as foreign manufacturers will give away their produce on threat of home production, there ought to be no difficulty in keeping prices down. And when the alternatives offered are a certainty of increase now against a problematical increase in the undefined future, it is but natural to take the chances of the future.

We do not need to ask, with the *Spectator*, where are our killed industries? But we must admit that killed industries have a peculiar habit of coming to life again. The Chamberlain family are providing arguments on both sides. Mr. Joseph is concerned for the one side, Mr. Arthur provides instances on the other. He relates that a manufacturer of glass prisms for chandeliers lost his trade from foreign competition. He started in the manufacture of the chandeliers, and made a fortune out of them. To point the moral, the General Electric Co. may extend their manufacture of arc lamps if, as we trust, they be denied the protection Mr. Byng seeks on arc lamp carbons.

We agree with Mr. Byng that general prosperity is very much a matter of individual selfishness. That is probably what he meant, though he put it a little differently—"the welfare of the country depends on the selfishness of the individual manufacturer." It is the selfishness of the individual manufacturer plus the selfishness of the individual purchaser which maintains the balance of general benefit. But we are less anxious to argue such points than we are to bring inquiry to bear on the effect of protection in the direction asked for. Distorted vision needs to be counteracted as misapplied sentiment needs, as far as possible, to be eliminated from business. Patriotism implies the possibility of sacrifice on the part of the patriot. In this case, at any rate, Protection implies the transfer of the sacrifice to other shoulders. "We are not going to stand a big loss every year for the public benefit," is a statement which is inconsistent with patriotism, but is quite in accord with sound business. It needs only one correction, and that is in the assumption that there is any public benefit in the individual loss.

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**The I.E.E. Building Fund.**

THOSE of our readers who are members of the Institution will have received, during the past week, a notice to the effect that a meeting will be held *to-day* (Friday, July 31st) at the offices of the Institution, to consider a resolution. The latter provides that the purchase of property in Tothill Street at the price of £16,500, and the sale of "such of the investments of the Institution as the Council may select" to provide the purchase money, be sanctioned.

Seeing that the matter is thus suddenly brought forward (on the score of urgency, it may be, in order to avoid the loss of an opportunity), and remembering that the great majority of the members of the Institution are dwellers in the provinces, it appears that this very important question is likely to be settled by the votes of a small minority; possibly many even of the London members will be unable to attend, so that, in reality, the motion will be put forward and passed by the Council. But why this haste? If we mistake not, the sum named above practically comprises the whole of the investments which are not ear-marked for certain specific purposes, such as scholarships, prizes, and the benevolent fund. Obviously, the object is to obtain a site upon which to erect, at a future date, a "PERMANENT HOME" for the Institution. For the desire of our fellow-members to meet in their own hall, and take tea at their own table, we can, indeed, have no feeling but sympathy; we trespass unduly upon the generous and ungrudging hospitality of the Civil Engineers, to whom, indeed, a heavy debt of gratitude is due. But the sad fact cannot be ignored, that there is no prospect of acquiring such a home for many years to come. There is always the danger, of course, that Mr. Carnegie will come forward with a million to provide a library and a free teatable for the members, with a conventicle attached; this peril, however, is as nothing compared with the grave step contemplated by the Council. We feel that this resolution ought not to be carried in hole-and-corner fashion; the opinions of the provincial members ought to be ascertained, and a poll taken of their votes. We, therefore, earnestly appeal to all members who are in a position to do so, to be present this afternoon, prepared to vote against the proposal of the Council, unless *convincing* reasons are brought forward for adopting another course. We may add that we do not voice our own opinions alone; as a matter of fact, no one with whom we have discussed the matter is in favour of the motion.

We are unable to spare space for further discussion at the moment, but at an early opportunity we shall recur to the matter. We may, however, point out that the building of the Civil Engineers is likely to be absorbed, sooner or later, into the Government offices, and a splendid opportunity will then be presented for the erection of a single central institution, to accommodate all or most of the engineering societies, and to combine a number of advantages. This is no new idea; it has been seriously discussed, for instance, at Manchester, and it deserves the most careful consideration before it is dismissed, or shelved by a precipitate action such as that set down for this afternoon.

## COMPOUNDED ASYNCHRONOUS MACHINERY.

By G. HOOGHWINKEL, M.I.E.E.

*(Concluded from page 130.)*

*(b) Compounded Asynchronous Machines.*

I have explained that as generators on a non-inductive load, these machines are compounded by the induction rotor-currents, and that there is no armature reaction in that case because of the watt component and the induction current being in phase. On inductive load, however, the full armature reaction exists. This armature reaction is necessary, as far as the *internal* wattless current of the machine is concerned, for parallel working.

In order to effect this compensation for *outside* wattless currents, we may, by the addition of three more brushes, lead also the main stator current through the rotor. This produces the necessary ampere-turns in the rotor to compensate for the wattless ampere-turns in the stator, and the demagnetisation of the field can be so prevented. In order to get a standard type of rotor for different voltages, transformers are used for supplying the necessary compensating and compounding current (fig. 12).

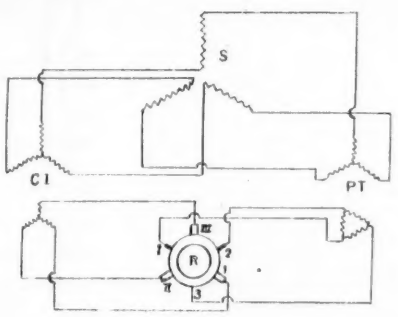



Fig. 12.

The same type of winding as for compensated generators is used, mostly three-phase winding with parallel branches. This winding has the additional advantage that the rotor may be used for a compensated as well as for a compounded generator, or as a motor with slip-rings.

There are six brushes and two transformers, one compounding transformer in series with the stator windings, and an exciting transformer, the secondary of which is mesh-connected in order to get a phase difference of 90° with the terminal voltage.

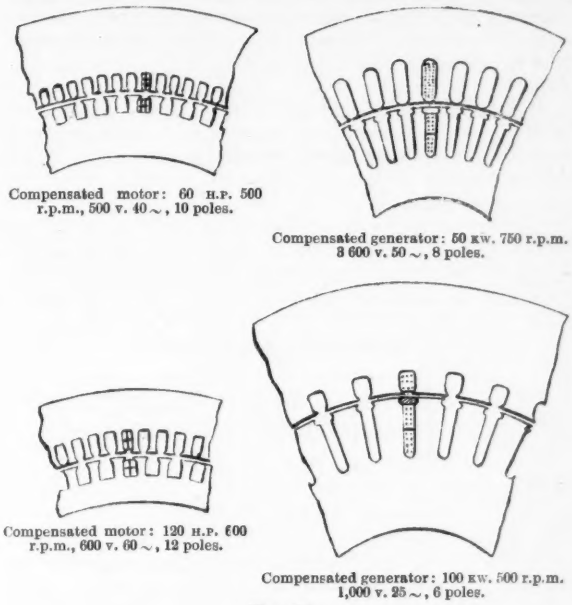
In order to regulate a machine, we must first fix the brushes for no-load, then regulate the current transformer on a purely inductive load, so that the pressure remains constant on full and no-load. This is the case when the compounding current *alone* excites the machine. The last regulation is to fix the brushes for full-load, and the machine is compounded for all loads. Of course, the commutator is larger than on a compensated generator.

In fig. 13 we see a number of stator and rotor windings of existing compensated machines. The stators are normal; only the rotor has been altered, in order to make room for the exciting ampere-turns. The wide slots allow former-wound bars to be used. The compounded machines have practically all the same rotor, with six slots per pole.

In fig. 14 is shown a 500-KW. compounded generator for coupling to a turbine at 2,500 revolutions. The voltage was 2,100 volts, and the frequency 40. The generator had therefore two poles, and owing to this great width of pole-pitch there are 12 slots per pole.

The rotor slots are very deep, and, therefore, the rotor material is very effectively used. If we compare this rotor to an ordinary two-pole synchronous generator with revolving field, we see that the asynchronous machine has many advantages. The poles are sub-divided and less deep than the poles on a synchronous generator, which again results in less leakage. Form-wound coils are used, and the whole machine is much smaller and lighter.

As we need not care about armature reaction, being able to compensate for it on wattless currents (for watt currents it compounds automatically), we may choose our airgap only with regard to the mechanical construction. Also the amount of copper on the rotor is far less than with a synchronous machine, where it is about 3—4 times the armature



Compensated motor: 60 H.P. 500 r.p.m., 500 v. 40 ~, 10 poles.

Compensated generator: 50 KW. 750 r.p.m. 3 600 v. 50 ~, 8 poles.

Compensated motor: 120 H.P. 600 r.p.m., 600 v. 60 ~, 12 poles.

Compensated generator: 100 KW. 500 r.p.m. 1,000 v. 25 ~, 6 poles.

Fig. 13.

copper. As with all asynchronous machines, the field copper is here less than the armature copper, and consequently the excitation losses are far less.

In short, we may safely say that compensated asynchronous machines are simpler, cheaper (because of their higher output), and of more mechanical design, than synchronous machines, and, in addition, they have the advantages of every asynchronous, over a synchronous machine,

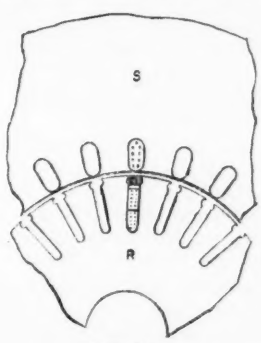



Fig. 14.

without the disadvantages as known hitherto. They are specially adapted to high speed engines and turbines, although they can perfectly well be used with low speed engines as well.

The writer hopes he has succeeded in giving a general idea of the advantages and construction of this new type of machines, theoretically and practically. As mentioned already in the first part of this paper, the credit of applying to induction machinery the idea of producing a revolving field by means of a low frequency current, belongs largely to Mr. Heyland, as explained in his various publications in the *E.T.Z.* and elsewhere.

With reference to compensated and compounded machines and their adoption for different classes of work, we may take it that the compensated machine will be mostly used as a motor, because of its power factor being 1, further as generator working in parallel with existing plant, and as generator on any non-inductive load, lighting, &c. It is also the ideal machine for a power plant with two machines, one at each end of the line.

Compounded machines will be used as generators on an inductive load, and as generators in parallel with synchronous or compensated machines on inductive loads.

They are not so much asynchronous as the compensated machines, in fact, they are almost synchronous in speed and frequency when exactly compounded. Therefore they are well adapted to work in parallel with a larger number of compensated machines, and act as leaders, just as one governor acts on the whole station when in parallel with other engines of which the governors are not in use.

In this case the compounded machine supplies the watt-current according to its output, and also, quite automatically, the wattless current of the whole station.

If, in addition to the generators, we also compound some of the larger motors in the above example, then the compounding has only to supply the wattless current of transformers on no load, small, non-compensated motors, and starting currents.

We see that it is now possible to have many combinations which give alternating current machines all the advantages of continuous current machines, while preserving their own inherent qualities.

## THE HORSFALL REFUSE DESTRUCTOR AND FORCED DRAUGHT SYSTEM.

Among the few firms who have made a success of refuse destruction—a success judged from either the sanitary or commercial standpoint—the Horsfall Destructor Co., Ltd., occupy a position in the front rank. They were amongst the first to recognise the failure, either as a perfect refuse cremator or an efficient steam raiser of the old-fashioned low temperature furnace, and the introduction of their high temperature furnace for this class of work practically gave a new lease of life to what was at one time a discredited system.

The essential sanitary requirements in a successful refuse destructor are—

1. High temperature in furnaces and flues.
2. Complete incineration on the grate of all solid matter.
3. Exposure of all products of combustion, including waste gases, to the highest temperature for as long a period as possible, in order to render them harmless, innocuous and inodorous.
4. A secondary requirement is the prevention of the emission of dust from the chimney.

When all the above points are realised, as they are in the Horsfall destructor, the results cannot be other than satisfactory from the point of view of the sanitarian.

There is, however, another and important point to consider, which is a commercial one—viz., economy in operation and upkeep.

This item means more than mere low cost of labour; it involves also a low initial cost and simplicity of design, the latter, of course, materially affecting both the labour item and the cost of repairs.

The possible utilisation of the heat generated also depends very largely upon the design and general arrangement; but the extent to which this can be made use of and the efficiency of the destructor as a steam-raiser are matters dependent to a large extent upon local conditions, as is also the profitable utilisation of the clinker and other residuals. Given equal conditions, there is probably very little, apart from first cost, to choose between the performances of the two or three types of destructors which are recognised as being representative of the best and most up-to-date practice.

As is well known to those who have followed the development of the destructor furnace, the Horsfall Destructor Co. has never departed, except in matters of detail, from their original design, and the results obtained have amply justified their faith in the cellular arrangement.

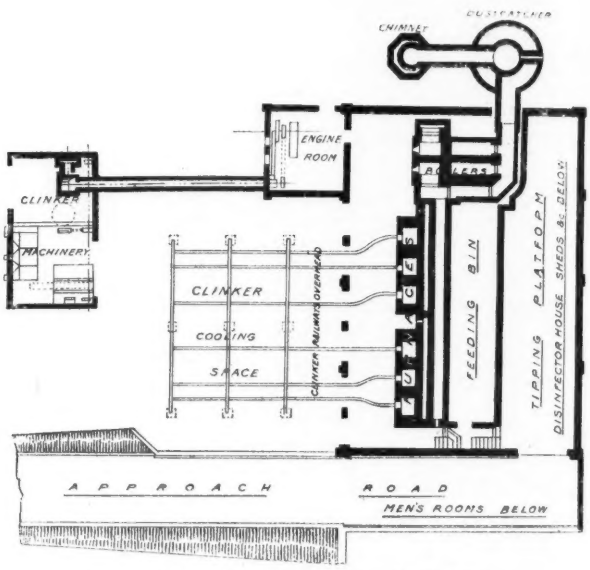
Each furnace is practically complete in itself, and consists of a grate having an area of about 25 sq. ft., at the back of which is a sloping drying hearth on to which the refuse is tipped from a platform above. The flue passes diagonally over the furnace, starting at the front and working backwards to a main flue or combustion chamber. The gases given off from the drying refuse on the hearth must, therefore, pass right over the full length of the fire in order to reach the flue, and in doing so are rendered harmless,

As the refuse in the grate is consumed, that on the hearth is raked forward and a fresh supply dropped on to the hearth.

The temperature of the furnace is maintained at a very high point by means of a powerful forced draught, and Horfall's may be justly styled the pioneers of the high temperature type of the destructor.

The Horsfall destructor has the distinction also of being the first to be used in connection with electricity works. This was at Oldham, and during the years 1891 to 1896, the cost of repairs averaged only 2½ per cent. on the capital outlay. The labour cost at the Oldham destructor is 9¾d. per ton, and the saving to the electricity works is equivalent to 6·3d. per ton of refuse burnt.

In this country, Bradford is looked upon as the town which has brought the economical utilisation of destructor residuals to its highest pitch. The making of mortar, concrete, artificial flags, bricks, &c., from the clinker has been reduced to a commercial industry, and, instead of




Plan of Horsfall Destructor.—Moss Side.

costing the ratepayers anything to destroy their refuse, it is really a source of profit to them, the gain amounting to several hundred pounds a year. The six destructors erected in various parts of the town, capable of dealing with 300 tons a day, are all of the Horsfall type.

The Horsfall Co. are also credited with erecting the largest refuse destructor in the world. This is at Hamburg, and has a capacity of 280 tons per day. From the official report* prepared by the late chief engineer, Herr F. Andreas Meyer, upon the five years' working from 1896 to 1900, we learn that not only has the destructor given every satisfaction from a hygienic point of view, but that the total expenses, including costs of cartage, labour, maintenance, repairs, office expenses, &c., are, after deducting the income from the sale of clinker, electricity, &c., less than the expenses of transport to the surrounding agricultural districts would be if a destructor were not used.

The actual saving per annum, based on 74,000,000 kilos. is 12,802 marks.

This result must be highly gratifying to the Horsfall Co.

One of the most successful destructors in London is that erected by the Horsfall Co. at the Fulham electricity works.

During a 16-hours' test by the consulting engineer to the borough, the evaporation was 1·15 lbs. of water from and at 212° F. per pound of refuse, over and above that required for the steam jets used for the forced draught. The financial results have been so satisfactory that they were recently commented on in one of the dailies, under the headline "Gold in Rubbish."

To comment on all the excellent results published in connection with this type of destructor would take up more space than we can spare, but the company will, no doubt, be

* Published in German by Friedrich Viewey & Sohn, Brunswick

pleased to furnish copies of the tests and reports to anyone sufficiently interested to write for them.

A not uncommon source of annoyance in connection with the use of destructors, is the fine dust which occasionally finds its way up the chimney, and the deposit itself in the vicinity. To prevent this the Horsfall Co. have designed a dust catcher, which is placed in the main flue, consisting of a swirling chamber with baffle plates, which intercept the dust and cause it to settle before reaching the chimney. This device is shown in the accompanying plan of the Moss Side destructor, which is a good example of the latest practice.

A noteworthy feature of this plant is the extremely low cost of labour. The stokers are paid 30s. a week, and the trimmers 26s. a week; only two men are employed in each shift of eight hours, the total cost of labour being only 7½d. per ton of refuse dealt with. This is not a test figure, but an average cost during 12 months.

As already mentioned, in order to make an economic success of refuse destruction, it is essential to utilise not only the heat developed, but to turn to account the bye-products, such as clinker, fused dust, and other solid residuals. This point has been fully developed by the Horsfall Co., who can supply not only the necessary machinery for making mortar, concrete, flags, and bricks from the clinkers, but also supply solder-extraction furnaces for the recovery of solder from the old tin cans that in some localities are found in considerable quantities in the refuse.

Some figures given from actual experience show a profit over £1 a day as a result of the use of such a furnace.

Quite apart from the subject of refuse destruction, the Horsfall Co. do a large business in the Laidis system of forced draught. This consists in an improved form of steam-jet blower, and the tests published show very marked increase in economy by its use. Thus at Merthyr Tydvil the net evaporation in Lancashire boilers 30 ft. by 7 ft. 6 in. was increased from 7·21 to 10·04 lbs. of water per 1 lb. of coal, at a steam pressure of 75 lbs. per square inch. And among other results is one in Cardiff, where the evaporation was raised from 6·942 lbs. to 11·623 lbs., or, allowing for the steam used in the jets, the net evaporation was 11·15 lbs. per lb. of coal, an increase of 60 per cent.

## NEWCASTLE TRAMWAYS AND THE QUESTION OF DEPRECIATION.

Mr. Bowden (of the firm of Thomas Bowden, Son & Nephew, chartered accountants, Newcastle-on-Tyne), the professional auditor, has presented his report to the City Council, date June 30th, 1903, on the tramways system. We make the following extracts from this very timely and interesting document, and we believe that they will command the attention of all who have anything to do with the finance or managerial departments of electric tramway systems.

| | | | |
|---|---|---|---|
| The loans raised for tramway purposes amounted at March 25th, 1902 (after deducting £6,771 19s. 9d. repaid), to ... ... ... ... ... ... ... | £683,228 | 0 | 3 |
| Add borrowed or transferred during the year, less instalments repaid and accrued ... ... ... | 90,397 | 5 | 9 |
| Outstanding loans at March 25th, 1903 ... ... | £773,625 | 6 | 0 |

During the year capital expenditure amounting to £230,256 has been incurred in connection with the undertaking:—Balance March 25th, 1902, £673,338; further expenditure, £230,256; balance March 25th, 1903, £903,594. The tramways were opened for traffic on December 16th, 1901, and since that date a regular service has been maintained.

"In my last annual report to the Council I mentioned that as the tramways system, so far as then completed, had only been in operation some 3½ months it was not considered that any useful purpose could be served by preparing a statement of profit and loss for that period, but revenue accounts for the periods from December 16th, 1901, to March 25th, 1902, and March 26th, 1902, to March 25th, 1903, have now been prepared. These have been certified, and the table at the bottom of the page is an abridged statement for the 15½ months ended March 25th, 1903:—

It is generally accepted that no balance on revenue or profit and loss account can be considered as profit, until adequate allowance has been made for that deterioration in value which the yearly expenditure for repairs is not sufficient to permanently check. The rate of depreciation should be calculated on the probable "life" of the property under ordinary conditions; and should provide against the inevitable wasting of the asset, assuming that it is kept as fully repaired as possible out of revenue.

The conditions affecting municipal undertakings are somewhat different to those of private or public companies. In the case of the latter, the capital of the subscribers when once received, is not repaid until the winding up of the company; consequently, careful provision is necessary before arriving at the divisible profit in order that the capital may be preserved intact, and that present shareholders may not be unduly favoured by improper payment of dividends at the expense of those who may come after. In the case of municipal undertakings, on the other hand, loans must be repaid within specified periods, and the general principle underlying the decision as to the term is supposed to be the "life" of the work for which the loan is granted.

Hitherto these loans have been principally in respect of works of an unremunerative or unrealisable nature, or both, but now that municipalities have entered more energetically into the sphere of trading, conditions not originally anticipated have arisen.

The loans for the tramways capital expenditure under the Act of 1899 have been approximately granted on the following terms:—Permanent way, purchase of tramways and buildings, 30 years; machinery and electrical equipment, 20 years; cars, 15 years; although, in the Act of 1902, provision is made for the repayment of loans for equipment over 30 years.

If the property comprised under the above division has, in each case, a probable "life" equal to the term for which the loan to pay for it has been obtained, and provided always that on the expiry of the loan, permission will be granted to re-borrow, further depreciation than the provision for the repayment of the loan would appear to be uncalled for.

It is generally acknowledged, however, that the probable "life" of certain of the assets of a tramway undertaking is shorter than the term for which the money is borrowed, and the consideration of the following questions becomes necessary.

(*a*) Whether such a sum shall be provided, in addition to the loans fund contribution, as will be sufficient to renew the asset at the termination of its useful "life," without having recourse to re-borrowing?

(*b*) Whether such a sum shall be annually set aside as will create a special repair fund, to maintain the system in a working condition, in addition to the contribution to the loans fund?

(*c*) Whether only such sums shall be charged yearly as will leave the asset comparatively valueless at the date when the repayment of the loan falls due, redemption having been provided for that purpose independently?

The conclusion arrived at on the consideration of these questions will serve as a guide to the basis on which depreciation is to be calculated.

It must be admitted that the experience with electric tramways being comparatively short in this country, it is difficult to estimate with precision, the probable "life" of different sections of a tramway undertaking; but in the light of such experience as has been gained, some precedents have been established and a reference to these may be profitable.

Mr. D. McColl, of the Glasgow Corporation Tramways, in a recently published book on tramway accounts, gives the following rates of depreciation:—Permanent way, £450 per mile of single track; rail bonding, 7½ per cent.; ducts and manholes, 2½ per cent.; feeder cables, 3 per cent.; poles and rosettes, 3 per cent.; overhead wires, —; section boxes, say, 4½ per cent.; buildings, 2½ per cent.; machinery and plant, works, 7½ per cent.; power and sub-stations, 5 per cent; rolling stock, 7½ per cent.; furniture, 2½ per cent.; uniforms, 50 per cent. He also suggests, as an alternative, in a table of estimated income and expenditure, that depreciation should be calculated at the rate of 2·20d. per car-mile.

During my audit I have had interviews with your tramways manager and engineer, Mr. A. E. Le Rossignol, and have seen the

Newcastle-upon-Tyne Corporation Tramways.—Abridged Revenue Account.

| Expenditure. | Dec. 16th, 1901, to March 25th, 1902. | March 26th, 1902, to March 25th, 1903. | Income. | Dec. 16th, 1901, to March 25th, 1902. | March 26th, 1902, to March 25th, 1903. |
|---|---|---|---|---|---|
| | £ s. d. | £ s. d. | | £ s. d. | £ s. d. |
| Power, sub-station and distribution expenses ... ... ... | 2,056 14 4 | 8,703 4 8 | Traffic receipts ... ... ... | 21,166 10 7 | 150,334 5 8 |
| Public lighting ... ... ... | — | 460 14 11 | Public lighting ... ... ... | — | 3,100 0 0 |
| General expenses ... ... | 1,403 5 1 | 9,133 1 10 | Rents, advertising and sundries | 4 13 6 | 387 16 0 |
| Traffic expenses ... ... ... | 8,080 18 3 | 56,731 5 7 | | | |
| Maintenance ... ... ... | 1,436 8 5 | 14,284 15 2 | | | |
| Balance ... ... ... | 8,193 18 0 | 64,508 19 6 | | | |
| | £21,171 4 1 | £153,822 1 8 | | £21,171 4 1 | £153,822 1 8 |

D.

report on the subject of depreciation, presented by him jointly with the city engineer to the Tramways Committee. In this report it is stated that "renewals can be met by laying aside annually a sum of £24,700" which it is intended should be invested and allowed to accumulate. I understand that this calculation is based on the average probable useful "life" of the assets.

Further, the opinion as expressed by Parliament may also serve as a guide to the rate of depreciation on machinery and plant, and evidence of this is forthcoming in what is now generally known as the "Dundee Clause," the latter part of which reads as follows:—

"Provided that if in any year the revenue exceeds such expenditure, the Corporation shall carry such excess to a reserve account to be used in providing for deficiencies and contingencies, and that should there be a deficiency in any year it shall be provided for in the estimate for the following year by drawing from reserve account or varying the tolls, fares and charges, or reducing working expenses, or be carried to a suspense account and reduced gradually over a period of years not exceeding five. Provided also that in making the estimates aforesaid and balancing accounts at the end of such year, the depreciation on machinery and plant shall be at 3 per cent. on the first cost thereof."

The rate mentioned in the "Dundee Clause" would appear to be the minimum that Parliament is at present disposed to consider should be provided on plant and machinery in addition to the provision for repayment of loans.

By way of comparison, the approximate sums necessary to be provided on the basis laid down by each of the authorities referred to are submitted:—

(*a*) Messrs. Le Rossignol & Edge, in their report, consider that depreciation is taking place annually amounting to ... ... ... ... ... ... ... £32,543
which could be met by investing and accumulating annually £24,700.

Note.—This amount would be slightly increased on the total expenditure to March 25th, 1903.

(*b*) Taking the percentages of depreciation recommended by Mr. McColl, and calculating on the amount of value of property considered by Messrs. Le Rossignol and Edge to be depreciating at a greater rate than that allowed for the repayment of the loan, the annual sum required is ... ... ... ... ... ... ... £28,916

(*c*) Adopting Mr. McColl's bases as far as they apply, calculating on the whole of the capital expenditure, and with a view to leaving a sufficient fund for the renewal of the undertaking, as well as leaving the same free of debt on the termination of the loans, the annual sum required would be ... ... ... ... ... ... £39,749

(*d*) Calculated on the basis of 2·20d. per car-mile, the amount required would be ... ... ... ... ... £30,984
(Subject to increase when a full year's running on the whole system is obtained.)

(*e*) The "Dundee Clause" which deals with depreciation on plant and machinery only provides that 3 per cent. shall be set aside. This in the case of Newcastle would appear to be about ... ... ... ... ... £11,500

The first four of these suggestions have for their object the renewal of each asset on the expiration of its probable "life," thus keeping the system intact as well as leaving the undertaking free of debt at the termination of the loans period.

The principle of calculating depreciation according to the car mileage (*d*) has much to recommend it, as periods of heavy traffic, such as holidays, entail a greater depreciation than periods when fewer passengers are carried.

The Dundee Clause (*e*) deals *only* with depreciation on plant and machinery, and does not appear to provide for renewal of other assets, as, for instance, permanent way.

In the foregoing, depreciation only has been considered, but it is equally important that a reserve fund should be established to provide for any extraordinary expenditure that may become necessary in consequence of the "antiquation" of the whole or any part of the system. Having regard to the comparative infancy of electrical science, there is every reason to anticipate that great changes may take place in the future, rendering existing systems liable to further heavy expenditure to keep pace with the altering conditions. A reserve fund is, therefore, necessary, so that, when the time comes, the changes may be carried out without hardship to a future generation who may be called upon to assume the remaining liability of the present loan debt.

The Council have already before them an illustration of the necessity for considering this in the case of the old horse tramways. For some years to come the interest on the horse tramways loans will have to be provided, thus casting a burden on future ratepayers, who will have derived no corresponding benefit. The balance available for depreciation and interest and redemption of capital is £69,452 10s. 1d.

The amount for interest on and redemption of loans during the period covered by the working of this system is £52,407 10s. 6d. Deducting this from the above surplus, there remains a balance to the credit of revenue account of £17,044 19s. 7d. available as the nucleus of a depreciation and reserve fund, the further annual provision for which will depend upon the basis decided upon by the Council.

The balance to the credit of sinking fund account, representing loans repaid, amounts to £33,710 14s.; the amount due to the City fund (for advances made during the construction period) after deducting £3,000 repaid, is £13,819 10s. 6d., exclusive of interest, which is in dispute. Included in the assets there appears an item under the heading of "Interest on, and redemption of loans during construction" of £20,093 2s. 5d., which is to be written off out of revenue, as no power exists to capitalise, as is generally the case in the construction of large undertakings.

### Horse Tramways.

Reference to the balance-sheet of the horse tramways will show that the liabilities of the Corporation, in respect of loans and stock on this account amounted to £46,662. The available assets are as follows:—

| | | | |
|---|---|---|---|
| Cash on hand, capital account ... | £8,796 5 9 | | |
| " " revenue account ... | 5,822 10 10 | | |
| | | £14,618 | 16 7 |
| Stores estimated to realise ... ... ... ... | | 284 | 10 0 |
| Debtor ... ... ... ... ... ... ... | | 60 | 17 6 |
| | | £14,964 | 4 1 |

An amount due in respect of an outstanding debt, £442 16s. 10s., is disputed and is not included.

| | | |
|---|---|---|
| The invested balance necessary, as at March 25th, 1903, to provide, without further contribution, for the redemption of outstanding loans in 1925, should have been ... ... | £24,352 | 4 0 |
| The amount actually to the credit of this fund, as shown by the account was ... ... ... | 15,216 | 4 0 |
| Leaving a further sum to be invested of | £9,136 | 0 0 |

It seems important that an investment should at once be made of the cash in hand on capital account, and of so much of the balance on revenue account as may be necessary to make up this amount. This would then leave a balance of £5,828 4s. 1d. available for the yearly payment of interest, amounting to about £1,530, which would suffice for nearly four years to come. After this balance has been exhausted, the interest in respect of these loans will become a charge on the rates unless taken over by the Tramways Committee.

## LEGAL.

### G. F. Milnes & Co.

Before Mr. Justice Swinfen Eady in the Chancery Division on the 24th inst., Mr. Micklen, K.C., moved in the matter of the Bank of Liverpool, Ltd., *v.* George F. Milnes & Co., Ltd., and the Law Guarantee Trust, Ltd., for the appointment of a Receiver in the business of George F. Milnes & Co., electric car and carriage manufacturers, Liverpool, of which the plaintiffs and the Law Guarantee Trust were debenture holders. The bank also held 15,000 debentures payable on demand, and although they had demanded payment, nothing had been paid. The bank had for some time past been providing money for wages, &c., to enable the business to be carried on.

Mr. Eve, K.C., for the defendants, said it was not quite true that the bank had been providing money to carry on the business, because it had been raised by overdraft. He asked that the matter should stand over for a week. They could pay the wages and carry the business on in the meantime without recourse to the bank, and they were prepared to give a reasonable undertaking to protect the bank. There was a prospect of disposing of the business on terms which would secure the bank and leave something for the shareholders.

On the terms that the defendants undertook not to consent to any judgment against them nor to do anything which would prejudice the debenture holders in the meantime, the motion was allowed to stand over.

### Fiford *v.* Scullard.

At Portsmouth County Court, on July 24th, Mr. E. T. Fiford, electrical engineer, of Southampton, sued Mr. Scullard, of the Totterdill's Hotel, Portsea, for £40 3s. 2d., balance of account due for installing the electric light at the hotel. Defendant counterclaimed for £35, the sum paid on account.

Plaintiff's case was, that the fittings passed the Corporation test, and that when the work could have been finished in a day or two to meet the insurance company's conditions, plaintiff was refused admission. Plaintiff declared that the wire used was properly insulated, and that the work was well and properly done.

For the defence, Mr. C. F. Quick, electrical engineer, of London, deposed that the fittings were dangerous. India-rubber was not used on the wires for the insulation, but a composition, while the switches, which were of cheap German make, were defective. The whole of the hotel had been rewired.

Judge Gye said he thought the plaintiff had been badly treated, as he had not been given a chance to complete the work properly. He had done his work, though, in a very scamping manner. There would be judgment for plaintiff for £3 on the claim, and the counterclaim would be dismissed.

### Electric Tramways Construction and Maintenance Co.

The petition of E. Horton and others for the compulsory winding up of this company was in the list for hearing before Mr. Justice Byrne on Tuesday last.

Mr. Kirby, who appeared for the petitioners, said that negotiations were still going on, and he understood the position was unchanged. Affidavits had been filed holding out hopes of payment in full, if time were allowed. As the petitioners did not want to destroy the assets, he would consent to an adjournment.

Mr. Ashton Cross, for the company, said his clients hoped by the sale of some light railway orders to pay the debenture-holders and creditors in full, if time were allowed; but he was afraid there would not be any for the shareholders.

After some discussion, Mr. Justice Byrne directed the petition to stand over until the first petition day in next sittings, the undertaking given by the company not to consent to judgment in a debenture-holder's action, &c., being continued in the meantime.

## PARLIAMENTARY.

### Plymouth Corporation Bill.

This Bill which, during its progress before the House of Commons, was reported upon somewhat fully in the Electrical Review, on July 23rd, came before a Select Committee of the House of Lords presided over by Lord Camperdown. By the Bill it was sought to construct certain tramways in the borough, and one outside the borough, and there were some rather large borrowing powers sought. The House of Commons Committee passed the preamble so far as the tramways were concerned, but strong exception was taken by opponents to the financial clauses, and charges of irregularity in the finance of the borough were made. As a result, the Committee finally passed the preamble, subject to the Government audit as set forth in Section 272 of the Tunbridge Wells Act being inserted.

Mr. Balfour Browne, K.C., again represented the promoters, and said that with regard to the tramways the opposition of Devonport was now confined to the point whether or not, in the assessment or amount they were to pay for running powers, the cost of widening the road should be included.

Evidence having been heard the Committee announced that they did not intend to accept the amendment proposed by Devonport.

Mr. Balfour Browne then addressed the Committee with regard to the audit clause, and said that when the clause was inserted in the Bill, Messrs. Burnard and Algar, who were the opponents, did not fully appreciate its effect. Since its insertion negotiations had taken place with the opponents, and Sir Ralph Littler, K.C., who represented them, was prepared to consent to the exclusion of the Government audit for the substitution of two new clauses providing for an audit by a skilled accountant, which would ensure a much more efficient audit of the accounts than would be possible under a Government audit.

Sir R. Littler said the proposed new clause would provide a careful check of the capital expenditure of the Corporation, and would protect the owners of property in Plymouth even more than a Government audit.

The Chairman adjourned the proceedings to allow of the attendance of Mr. Boyce, of the Local Government Board.

Mr. Boyce stated that the Board were not prepared to accept the clause proposed to be substituted for Clause 87 in the Bill, because the auditor appointed under the new clause would have no power to require documents to be placed before him, nor would he have any power to surcharge. Further, the clause would not prevent overdrafts. If anything was wrong there was no power under the clause to have it put right.

After considerable discussion, the Chairman announced that the Committee would not alter Clause 87 as placed in the Bill by the House of Commons Committee.

After consultation with his clients, Mr. Balfour Browne announced that the Bill would be withdrawn.

### Royal Commission on London Traffic.

Sir David Barbour presided on the 24th inst. over a sitting of the Royal Commission on Locomotion.

Mr. Harry Edwin Haward, the Comptroller to the London County Council, gave evidence in regard to the financial position of the tube railway companies of London. He said that the total capital involved in tube railway undertakings existing, authorised or proposed amounted to £50,277,000. The amount was made up as follows:—Tube railways in operation, £7,518,000; in course of construction, £18,493,000; authorised, but not commenced, £3,680,000; new railways (including extensions of existing railways) proposed by Bills as introduced into Parliament this session, £20,586,000. Witness then gave in details the financial position of the Central London, the City and South London, and the Waterloo and City Railways, and also gave particulars of the large number of tubes in course of construction. He said that he had come to the following conclusions with regard to the raising of capital, &c. Great difficulty had been experienced in raising capital for the various enterprises. The Central London Railway made more than one unsuccessful attempt to issue its capital to the public in the ordinary way, and its stocks were finally syndicated and issued in blocks; £672,000 of its 4 per cent. debenture stock was allotted to the Electric Traction Co., Ltd., the financial syndicate formed to construct the line. Then he understood that the issue of the Great Northern, Piccadilly and Brompton Guaranteed stock this year was unsuccessful, the underwriters having been left with 50 per cent. of the total. The Waterloo and City Co., being under the wing of the London and South-Western Co., was in a special position. In referring to the cost per mile, he said that that varied considerably. The Central London cost about £554,000 per mile for construction and equipment, and further expenditure had been incurred since the line was opened. The City and Waterloo cost less than £400,000 per mile; and although the latter had no lifts, one-third of the line had to be constructed under compressed air, and the terminal station at Waterloo was very costly owing to the necessary underpinning of part of the London and South-Western Railway terminus. The City and South London cost about £350,000 per mile. The cost of the Great Northern and City line was not yet known. The traffic receipts of all three undertakings actually at work were increasing, and the number of passengers was growing. In this connection he pointed out that each of the railways delivered its passengers in the heart of the City, two from the suburbs and one from an important terminus. The working expenses ranged between 45 and 55 per cent. of the gross receipts, but showed a tendency to the former figure. Those of the Central London stood highest at the present time. Witness then dealt at considerable length with the financial inter-arrangements "so far as known" of the Underground Electric Railways Co., of London, and Messrs. Speyer Bros., and the various tube companies, going into the history of the formation of the various companies.

At the conclusion of his evidence, Mr. Edgar Speyer went into the witness box and asked to have an opportunity of contradicting certain statements made by witness with regard to the raising of the capital of the Underground Co.

The Chairman said that they would hear Mr. Speyer when the Commission resumed its sittings. The Commission then adjourned for the vacation. The date of the next sitting was not announced.

### North-Western Electricity and Power Gas Bill.

This Bill was before a Select Committee of the House of Commons, presided over by Sir F. Godson, several days this week.

Mr. Balfour Browne, K.C., who opened the case for the promoters, said that the Bill was to incorporate a company which should have power to supply electricity and Mond gas over an area of 2,000 square miles, which area would include the whole of Cheshire and portions of Derbyshire, Staffordshire, and Flintshire. In the localities proposed to be supplied were a large number of collieries, iron works, and factories of various kinds, which would take power from the company. It was proposed to place generating stations at convenient points. The power would in the first place be supplied to authorised distributors. The company would not supply electricity for lighting purposes. By the use of Mond gas the promoters hoped to supply power four times as cheaply as could be done by means of steam. There were a large number of petitions against the Bill from local authorities, gas companies, &c. The Corporations of Stockport, Hanley, Birkenhead, Crewe, Manchester, and Stalybridge were amongst the local authorities in opposition.

Mr. H. A. Humphrey, C.E., was called, and gave evidence at some length. He said that allowing for the difference in heating value, the price of the gas would be 8d. per 1,000 ft., against 2s. 9d., the average price charged for coal gas in the district.

Mr. H. A. Jones and Mr. Ferranti, engineers, also gave evidence. The last-named witness, cross-examined, said that he considered that the capital proposed to be raised, £1,500,000, would be sufficient. It would be absurd to raise a larger sum at the outset of the undertaking.

At this point the Chairman suggested that perhaps the promoters would consider whether they could leave Cheshire out of the Bill.

Mr. Wallace, K.C., for the promoters, said that that would not meet the views of the promoters. He could call a large number of witnesses to prove that the gas was really desired in Cheshire.

The Chairman said that the question was whether the capital would be sufficient to enable consumers to depend on getting the gas.

On the following day Mr. Wallace submitted a proposal on behalf of the promoters to the effect that, so far as the Mond gas was concerned, Cheshire and Derbyshire should be excluded from the area of supply in the scheme. That would leave Staffordshire, Denbighshire and Flintshire to the promoters. The generating stations in Cheshire should supply electricity only.

The Chairman, after consulting with the Committee, said that they were not inclined to leave Cheshire in the scheme for any purpose. With the exception of Cheshire they found the preamble of the Bill proved. Counsel for the promoters asked that they should be allowed to have a generating station at Bollington, near Macclesfield. This was refused by the Committee, but permission was granted for the erection of a generating station in North-West Derbyshire.

In reply to a question by the Chairman, Mr. Wallace said that the same capital as originally proposed for the whole of the scheme would be applied to the scheme as it remained.

On Tuesday the clauses of this Bill were considered by the Select Committee of the House of Commons, of which Sir F. Godson is chairman.

Mr. Balfour Browne, K.C., said that he understood that his learned friend Mr. Lloyd, who appeared for Stockport, wished to bring up certain clauses, which he (Mr. Balfour Browne) hoped to be able to show were not necessary, but were already covered by the Bill.

Mr. Lloyd said that the position was as follows:—Stockport had had to go to Derbyshire for a water supply, and large mains had been laid down, some of them being 27 in. in diameter. The promoters took power in the Bill to raise, sink, or otherwise alter the position of any of the mains which they thought necessary. He asked the Committee not to allow the company to do anything of the kind without the sanction of the Corporation of Stockport. The Corporation desired also to be further protected by the insertion of a clause preventing the company digging any trench for pipes, &c., within 3 ft. of the Corporation's 27-in. water mains. He submitted a further clause by which the Corporation were to hold the com-

pany liable for any extra expense incurred in connection with the water mains. With regard to any provisional order which the promoting company might obtain for purposes of distribution, counsel asked that such provisional orders should apply only to the company's area of supply, and should not be applicable to those counties which the Committee had already excluded from the scheme.

Mr. Balfour Browne, in reply, said that the first clause was absolutely unnecessary, as the Corporation would be fully protected. There were in existence in Lancashire water mains of much larger diameter than the mains of the Stockport Corporation, and yet there was no such clause as that suggested by Mr. Lloyd in the Lancashire Power Bill. In that case they were perfectly well satisfied with the protection of the general law. Then with regard to giving the Corporation notice of any repairs they found necessary, he contended that it was absurd to ask for a month's notice. As to the clause about provisional orders, he asked the Committee not to add the words "area of supply."

Mr. Lloyd said that compensation for any damage done to the water mains of the Corporation would be of no use; it would not give them a water supply. In regard to the proposed clause stipulating for a month's notice, he said that that referred to alteration in the mains. Under the existing law the company would be able to do any repairs without giving notice if they could show that the repairs were urgent. The Committee then considered the clauses and adjourned.

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### Brighton Corporation Tramways.

This Bill was before Mr. Heywood Johnson's Select Committee of the House of Commons on Tuesday. The Bill as original promoted was to extend the tramway system of Brighton by the construction of a line of tramway to connect the station with the Pavilion by way of King's Road and North Road; a line up Terminus Road and Buckingham Place to Seven Dials; a line from Seven Dials down the Montpelier Road; a line from Seven Dials up Dyke Road; and a short piece of line from Seven Dials along Goldsmid Road to the city boundary. Mr. Baggallay, K.C., opened the case for the promoters. He said that all opposition to the Bill had been withdrawn. The population of Brighton was between 123,000 and 124,000, and the rateable value was £858,000. When the Bill came before the Lords, the Corporation were forbidden to commence tramway No. 4, which ran up to the station entrance, until they obtained powers to construct a tramway connecting that tramway with tramway No. 3, on the other side of the station. That was done to prevent people from getting out of one tramcar and crossing the station forecourt. The connecting link could be made by the Corporation purchasing the property known as the Terminus Hotel. The tramway would then be carried over Trafalgar Street. The tramways would be worked electrically, as was the case with the existing tramways, and the current for the purpose would be generated at a power station at Shoreham Harbour. Shoreham Harbour had been chosen as a site, as coal could be brought up to the generating station very cheaply. The current would be taken to Brighton by a cable. At first it was proposed to lay the cable across the east arm of the harbour, but certain difficulties having been foreseen, such as the fouling of the cable by anchors, &c., it was now proposed to place the cables in an iron cylinder, 7 ft. in height, which cylinder would be approached at each end by a shaft with a headway of 10 ft. For the purpose of constructing this tunnel it was proposed to borrow £10,000. A number of witnesses were then called, including the Mayor of Brighton. Mr. T. B. Holliday, tramway engineer, said that the total estimated cost of the scheme was £55,000. In answer to the Chairman, Witness said that that sum did not include any land, but was merely for the construction and equipment of the lines. Mr. Kincaid, having given evidence to show that the curves were safe, the Committee found the preamble proved.

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*Tramway Orders Confirmation Bill* (*No.* 1).—This Bill came before a Committee of the House of Commons on Tuesday, and was ordered to proceed as an unopposed Bill.

*Tramway Orders Confirmation Bill* (*No.* 2).—On Tuesday the Chairman of Ways and Means considered this Bill. There was no opposition, and it was ordered to be reported for third reading.

*Sheffield Corporation Bill.*—Lord Morley's Committee of the House of Lords considered this Bill on Tuesday, and the preamble was found proved.

*Croydon and District Electric Tramways.*—This Bill was on Tuesday before Lord Morley's Committee of the House of Lords, and was ordered to be reported for third reading.

*Coventry Electric Tramways.*—On Tuesday this Bill came before Earl Morley's Committee of the House of Lords, and the preamble having been formally found proved it was ordered to go forward.

*Dover Corporation Bill.*—This Bill came on Tuesday before Lord Morley's Committee of the House of Lords, and was ordered to be reported for third reading.

*Shropshire and Worcestershire Electric Power.*—This Bill was before the Committee of the House of Commons on Tuesday, and was ordered to be reported for third reading.

*Salford Corporation.*—This Bill came on Tuesday before the Chairman of Ways and Means, and was ordered to be reported to the House.

*South Staffordshire Tramways.*—On Tuesday this Bill was before the Committee of the House of Commons presided over by the Deputy-Chairman, and the preamble was found to have been proved.

*Erith Tramways and Improvements.*—This Bill came before Earl Morley's Committee of the House of Lords on Tuesday, and was ordered to be reported for third reading.

*Kingston-upon-Hull Corporation.*—This Omnibus Bill of the Kingston Corporation was on Tuesday before Lord Morley's Committee as an unopposed measure, and was ordered to be reported for third reading.

*Bradford Corporation Bill.*—The Bill which the Corporation of Bradford are promoting in this session came before Mr. Heywood Johnstone's Select Committee of the House of Commons on July 21st. The object of the Bill is to empower the Corporation to construct tramways, waterworks, &c., and to exchange portions of their respective gas undertakings with the Urban District of Shipley, and to carry out various other undertakings. The promoters were represented by Mr. Waugh. He said that the Bill was unopposed, although it was down as an opposed measure. Mr. John H. Cox, the city surveyor, was called and gave evidence with regard to the proposed tramways. Witness said that the Corporation owned tramways of a total length of over 39 miles, of which three miles were outside the city boundary. The tramways were all worked by electricity. The Corporation now desired to construct certain loop lines, the estimated cost of which was £9,397, to connect the existing tramways. The whole of the Corporation's system of tramways was remunerative. Other sections of the Bill having been considered, a member of the Committee inquired why it was that the Great Northern Railway Co. were to be exempted from the clause dealing with electrical supply. Mr. Waugh replied that it was done as a result of a petition in the House of Lords. He understood that the exemption did not affect the Corporation, and he did not see any objection to it. The member asked if the effect would not be that the railway company alone would be entitled to demand connection without having to pay for a minimum supply of current. Counsel said that though it would give them that exemption the contingency would not be likely to arise. The company bought from the Corporation direct in very large bulk, and they would not be likely to require only a small amount of electricity. The clause was to prevent a person who made his own electric energy coming to the Corporation for a very small supply. The member said that it would give the railway company power to put down its own plant and yet have a claim on the town supply. The Chairman considered that it would give the same power to any tenant of the railway company. Ultimately the clause was struck out, and the Committee declared the preamble proved.

*Dewsbury, Batley and Birstal Tramways.*—Reporting to the House of Commons for the Committee which considered this Bill, the Chairman of Ways and Means points out that the Bill confers powers on the Corporation of Batley in reference to the adoption of tramways within the borough for the purpose of working the same by electrical power. It gives borrowing powers to the Corporation for the purpose of the erection and equipment of generating stations which are required for working their tramways. Such powers might be obtained under general Acts, but the monies borrowed could not under those Acts be charged on the security of the rent arising from the lease of the tramways, or on the borough fund and borough rate as proposed by the Bill. The borrowing powers were £44,100 for the adaptation of the Batley tramways, and £23,100 for the erection and equipment of station for generating electrical energy, and the period assigned for the repayment was in each case 30 years.

*Mid-Yorkshire Tramways Bill.*—The Deputy-Chairman has reported to the House of Commons in reference to this Bill that the time allowed for the completion of so much of tramway No. 1 as is within the Borough of Keighley is dependent on the failure of the Keighley Corporation to construct the tramway authorised by the Keighley Corporation Order for the present session of Parliament within the period limited by that Order, and might, therefore, be in excess of the period allowed by Standing Orders. Under the circumstances the Committee did not think the Standing Orders need be enforced.

*West Bromwich Corporation Bill.*—By this Bill a portion of the Corporation's Act relative to the construction of tramways in narrow roads is reported. It came before the Chairman of Ways and Means on Friday last as an unopposed measure, and was ordered to go forward for third reading.

*Kingston-upon-Hull Corporation.*—No opponents appeared before the Select Committee of the House of Lords on July 23rd, when this Bill came on, and it was ordered to be reported.

*Preston, Chorley and Harwich Tramways.*—This Bill, which has already passed the House of Lords, and which incorporates a company with a capital of £500,000 to construct tramways in the districts named in the title, came on Friday last before the Deputy-Chairman's Committee of the House of Commons. There was no opposition, and the Bill was ordered to be reported for third reading.

*Somerset Electric Power Bill.*—On July 21st the Committee considered the clauses. With regard to the use of energy for power, the Committee allowed 50 per cent. to be taken for lighting, although the Corporation of Bristol had asked that the amount should not exceed 20 per cent. Mr. Freeman, K.C., asked that the Committee should require meters to be provided, but the Chairman said that they could not settle a difficult question like that. On the question of appeal to the Board of Trade in case of differences between the company and the Bristol Corporation, the Committee decided that the determination of the Board of Trade that the consent of the Corporation to the company supplying energy within the city, as it existed, had been unreasonably withheld (so as to entitle the company to supply under the Act to any particular customer), should in such case relate only to the particular supply

in respect of which the consent of the Corporation should have been withheld, and should not be deemed to authorise the company to supply energy within the city, as it existed, to any person other than the consumer to whose intended supply such determination should rule. The Bill was ordered to proceed.

*South Shields Corporation Bill.*—This Bill came on July 23rd before Lord Morley's Committee of the House of Lords, and was ordered to be reported for third reading. The tramway estimate is £175,917.

*Baker Street and Waterloo Railway.*—On July 23rd the above Bill was before Lord Morley's Committee of the House of Lords as an unopposed measure, and was ordered to be reported for third reading. It extends the time for the acquisition of lands and the completion of the undertaking.

## HOT WIRE ENCLOSED ARC LAMPS.

By H. TOMLINSON-LEE.

It is generally accorded by those who have an intimate knowledge of arc lamps that in most cases the cause of break-down is from dash-pot troubles, the ultimate result being the burning of the coil.

It would appear that the coil is inseparable from the dash-pot, and that the dash-pot is the principal cause of trouble with the enclosed arc lamp. A partial remedy is to be found in so proportioning the coil and plunger that a reserve force is obtainable to overcome the increasing friction of a dirty dash-pot, but the limit to this method is soon reached, and after all it is only postponing the inevitable.

Since it is impossible to effectually eliminate dust, it is somewhat curious that no serious attempt was made to grapple with the question from a fresh standpoint until August, 1901, when Mr. C. E. Foster applied for Letters Patent in respect of a "hot-wire" lamp. It is true that others had got as far as the Patent Office before Mr. Foster, but they no doubt discovered that, although the idea was comparatively easy of conception, it was a very difficult matter to put it into practical form.

A later patent was applied for by Mr. Foster in December, 1901, after an interval of patient research and experiment,

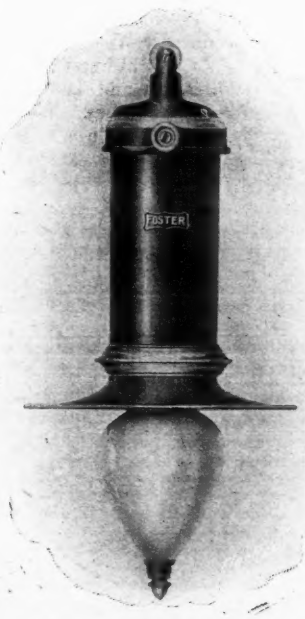


Fig. 1.

with the result that nine-tenths of the difficulties hitherto inseparable from the solenoid-controlled arc lamp have been overcome, and the solenoid abolished.

The "Foster" lamp is not perfection or infallible, but it certainly has fewer weak points, fewer fine adjustments and more chances of long life than is possible with the solenoid lamp. The fact is that few arc lamps of the earlier designs get the skilled attention their construction demands. For simplicity it cannot be denied that the "Foster" lamp is *facile princeps*. Fig. 1 shows the complete lamp, while fig. 2 is a sketch of the mechanism. The spring is in tension, and tends to raise the washer-clutch $C_l$, through the agency of the piece F, the link X, and the levers N and M. It is prevented from doing so by the thermo-expansive strip S. When the lamp is switched on the strip s becomes comparatively hot; the vertical expansion so obtained, is multiplied approximately by the cosecant of the angle between the strut B and the strip S, and transferred in a horizontal direction by the interposition of the strut, and the clutch is raised thereby. The resultant of the forces in the spring and the strip is upward in the strut, and is taken on the point of the same, which works in a "centre" and without friction.

The friction of the carbon sheath $C_s$ in the tube G and of the carbon at the chimney bush $C_b$ is negligible, as also at the trunnions of the levers N and M and the link X, whose duty is to transmit the difference between the forces in the spring and strip respectively to the clutch for the raising and

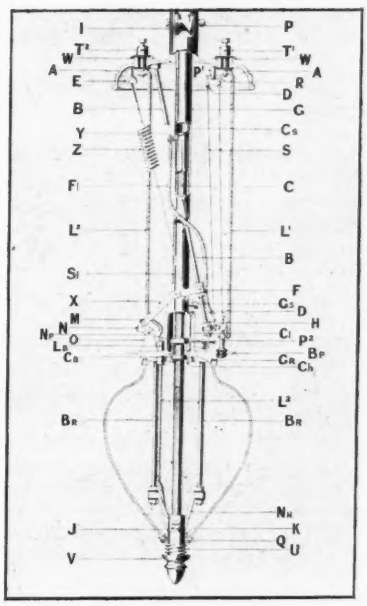


Fig. 2.

holding in the right position of the top carbon C. This difference, which is, of course, in favour of the spring, is so little in excess of the weight of the carbon and the sheath that the strain of the strip when hot is but a few ounces; the strip will stand without permanent elongation at least 10 times the strain that the spring can possibly produce in it, and will carry about three times the striking current without deterioration.

There is nothing in the lamp which, in the ordinary sense, is not fireproof. Current is carried by direct connections to the carbons, and there is no possibility of sparking at rubbing surfaces. The carbon sheath, clutch and chimney may be taken out, cleaned and replaced in a few minutes without taking the lamp down, and a new strip or any of the parts can be replaced with equal facility. This should certainly appeal to the consumer, especially where a large number of lamps are used.

The mechanism proper of the "Foster" arc lamp weighs $8\frac{1}{2}$ oz., and there is ample margin of safety even with these figures The strip is the soul of the lamp, it being responsible for the control of the striking and feeding mechanism. A strip which had been in a lamp used for outside lighting for over two years was lately examined. It was, of course, very dirty, but not rusty; no stretch was perceptible, and its action was as prompt as when first installed. It was tested up to 30 lbs., and broke at 46 lbs.; it exhibited great toughness, and the elongation before fracture was about 15 per cent. It may reasonably be expected that the life of a strip will be at least five years. If a strip fails a new one can be *hooked* on and connected by screws at each end in five minutes or less, and the dirty parts

removed, cleaned, and replaced in another five minutes—all this without removing the lamp, and at a cost of a few shillings. One cannot help contrasting this with the burnt-up solenoid lamp, which "must go back to the factory" for a month or so to wait its turn to be repaired, and then at a cost of from 30s. to 50s.

The foregoing remarks are intended to prove that the new lamp, in striking out into a new path, has entirely avoided the traps and pitfalls of the old one, and is, therefore, more likely to cause a reaction in favour of arc lighting by old users and others.

It is almost self-suggestive that the avoidance of the coil and dash-pot should bring with it additional advantages, and such is really the case. Mr. Foster finds that very little more than the internal resistance of the lamp and mechanism—about 2 ohms—is needed on direct current. Mr. Foster deals with high-voltage circuits by connecting three lamps in series, and he finds that in a case of 240 volts no resistance other than that of the thermo-expansive strip was necessary. The current was 5·5 amps. and the volts across the carbon points totalled 216 or 72 volts per lamp. Solid carbons were used, and there was no unsteadiness. This amounts practically to getting 50 per cent. more light for the same consumption of power as compared with the usual method. Similar results were obtained on a London circuit of 220 volts continuous. On 100 to 200 and 220-volt circuits the saving is from 10 per cent. to 25 per cent.

But it is on alternating circuits that Mr. Foster appears to get the best results. An alternating lamp has been under the observation of the writer, adjusted to work off a transformer; the current is 2·25 amps. at 220 volts, periodicity 50, consumption 495 watts, total losses in transformer, choking coil, &c., 58 watts. The transformer, which is a 3-way compensator of Mr. Foster's design, will manipulate two other similar lamps, and when the three lamps are switched on they are burning in series, each of the three sections of the transformer being a shunt across one lamp in the usual way. The power factor of the lamp itself is unity, and the choking coil absorbs very little power. "Foster" lamps will burn with non-inductive resistance in circuit, but the efficiency, though good, is not as high as is obtainable by the introduction of inductance. It is, however, anticipated that it will shortly be possible to abolish the choking coil, when the power factor of the whole circuit will be practically unity on an alternating current circuit.

As these lamps work three in series on 220-volt alternating current, it is to be presumed that they will work equally as well on circuits of higher voltage.

Perhaps the most remarkable characteristic of this lamp is its apparent indifference to circuit conditions, as will be shown by the following experiment. The writer was shown a pair of lamps adjusted to burn on 220-volt continuous circuits, and connected also by a double-pole throw-over switch to a 220-volt alternating circuit, periodicity 50. These lamps were switched over from a continuous-current circuit to an alternating-current circuit *without the arc breaking*. There was the usual difference in the light, but at first it was difficult to realise that any change had actually taken place.

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[We were recently favoured with an opportunity of inspecting a number of these lamps, burning under different conditions. The working of the lamps left nothing to be desired; the simplicity of the mechanism, and its smooth dead-beat operation, were most noteworthy—we never saw the lamps blink in the act of feeding, or misbehave in any other way. The extinction of one of three lamps in series on 220 volts A.C., with compensator, apparently in no way affected the other two. We also saw the interesting experiment referred to by Mr. Tomlinson-Lee—the switching-over of two lamps in series from D.C. to A.C., and *vice versâ*, without extinction of the arc.—Eds. Elec. Rev.]

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**Hythe Lighting.**—An understanding has been arrived at with the Folkestone Electricity Co. with regard to the public lighting of the borough, whereby it becomes entirely responsible. The T.C. will pay the company £560 per annum, covering all charges. Any further lamps are to be paid for at an inclusive fee of £3 15s. per annum, the Corporation providing the posts.

## CORRESPONDENCE.

### Protection or Fair Trade?

(This letter is in reply to the article under the above heading, which appeared in our issue of the 17th inst. This article was communicated to us, and it is understood that Mr. Byng addresses the author in his reply.)

I am glad that you have opened your columns to the discussion of our fiscal policy—a subject upon the solution of which the weal or woe of the country must depend. You were good enough to take as your text extracts from my book on Protection; this is the reason why I ask for the hospitality of your columns, in order to revert again to the subject.

To the casual reader you are apparently antagonistic to my views; this, however, is not the case. I have lately had large experience in converting so-called "convinced" Free Traders, and I recognise in your arguments the usual favourable symptoms preceding a sudden conversion. Your case is not hopeless. I acknowledge you use some very hard names against us "discourteous" Protectionists, and against the "great evils of Protection"; yet you who call yourself a Free Trader, and I, a Protectionist, agree substantially on many arguments and facts. You only choose to disagree with me as to the necessity of a remedy and as to the remedy itself. No doubt this will surprise you, but in order to convince you of your errors I will use your own arguments as a basis. I only ask you to follow me when my conclusions differ from yours.

*Selfishness.*—You begin by saying that "It certainly strikes one in reading the arguments of Protectionists that they are all based primarily on the basis of each man speaking for himself, or the special industry in which he is directly interested."

Here we thoroughly agree. Protectionists' arguments are first and foremost selfish, but we glory in this. We claim that our arguments are a thousand times better for it. We say that matters connected with so-called "Free Trade" concern traders and manufacturers before anyone else. Their arguments, based on their own experience, should carry more weight than those of learned professors, whose unselfishness is generally on a par with their inexperience. We say that a man who is not selfish is no good to himself, nor to his enterprises, nor to his country. We go further. One of our greatest complaints is the unselfishness of our opponents. We accuse our agriculturalists and landed proprietors of unselfishness amounting to cowardice. They have allowed free import of all agricultural produce, which has reduced their rents and the capital value of land to an extent estimated at nearly £2,000,000,000. Free Traders may admire such unselfishness, but we Proectionists assert that it is an enormous loss to the nation as a whole.

We also resent the unselfishness of lawyers in laying down the law upon the rise and fall of wages, when they never pay wages themselves. We resent the unselfishness of so-called "economists" and "experts," who have never imported or exported a sixpennyworth of goods, and who want to tell us how our imports are paid for. And above all, we object to the unselfishness of some journalists who wish to teach us "selfish" manufacturers the laws of the cost of production, when they have never produced anything but "copy" themselves.

I acknowledge in full that selfishness of which I have often been accused. I will quote from p. 246 of my book as follows:—"I have written this book with an object; that of securing for my industrial enterprises the protection which I deem imperative for their continuance and success."

I have spoken, written, and agitated for Protection, primarily for myself, my factories, and my workpeople. But I claim that in looking after myself I am advancing the best interests of the country in which I live, and if I honestly believe (as I do) that our present fiscal system jeopardises my fortune and the earning power of my workmen, then I consider it not only my right, but my duty, to let my views be known to all those who can help me to alter it.

I will not take your arguments in rotation, but according to their degree of importance, as there is repetition in some of them, and others can be treated under one heading.

*Cost of Production.*—To manufacturers this is all important. It is also important for the nation at large. If it can be proved that the cost of production here is higher, owing to our import policy, then it follows that our position as a manufacturing nation cannot be upheld for long. I have set that forth in my book with much deliberation, and, as I thought, with clearness; yet you profess to misunderstand the meaning of my arguments. In this respect you stand almost alone. All my critics have acknowledged the correctness of my quantity argument. The great French Free Trader, M. Yves Guyot, states in the *Fortnightly Review* for July:—"Mr. Chamberlain took an example out of Mr. Byng's book on 'Protection.' Mr. Byng was speaking of watches; Mr. Chamberlain substituted pounds sterling; that is the only difference."

But in spite of your seeming scepticism you practically agree with me by saying, "One knows that by manufacturing standard parts in large quantities the labour cost and the expenses may be very considerably reduced." Here we both agree, and, starting from a common basis, may I ask you to follow me a little further.

The quantity which a manufacturer can produce depends upon the quantity he can sell, and his selling capacity again depends upon the number and size of his markets.

*Markets.*—Therefore, the markets at the disposal of the producer must be acknowledged to rule the conditions which determine the cost of production. A manufacturer in a protected country has his own and our markets to sell in. For instance, an American has 70 million people, plus 40 millions to sell to; I have only 40 millions, and these I have to share with my competitors throughout the world; (this omits the neutral markets where we are supposed to be on an equality, but even there an Englishman is handicapped).

If my contentions are right (and you admit them in the main) the old Free Trade theories must go by the board. The basis of all these theories is cheapness; "a Free Trade country can manufacture more cheaply than a Protectionist country." The truth is quite the reverse; and when realising the fearful meaning of this truth, one cannot help shuddering when thinking of the abyss before before which we at present stand.

The question of markets leads to another favourite theory of the kindly Free Trader, namely:—Free Trade will bring peace and goodwill amongst nations. Ever since we have had Free Trade, England has been at war in some part of the world or other. We have been trying to conquer new markets all over the globe. Why? Because we have given away our own market and are being shut out from others with more severity year by year. So much for the connection between Free Trade and peace and goodwill of other nations towards us.

*Wages.*—You attempt to ridicule my statement regarding wages. I stated that I am prepared to pay higher wages if I have a protected home market to sell in, and preference in our Colonies. You compare me to the seller of tea who throws in a tea service with a pound of tea, and you call my undertaking "specious sophism"; saying that I wish to take in the simple, and to misle my workmen. Let anyone who understands the methods of modern manufacturing judge between us. If I have that security which Protection would give me by a large and continuous demand for my manufactures, I can be enterprising. I can lay out my works upon a large scale; specialise every part; adopt piece work throughout; save in supervision in the drawing office, in the counting house and on the commercial side.

I maintain that if I can do all this, I can pay higher wages and greatly reduce the cost of production. There is nothing Utopian, neither sophistry nor any "tea-service speculation" about this.

But here again, in spite of your little pleasantries, you do not disagree with me. You say after all, "accepting, however, the rise in wages." Thank you for so much. But then you say, "the manufacturer does not pay them; the buyer, as usual." Here you drift into the consumer argument and I will give you my answer to this presently.

*Retaliation.*—But before I do this, let me say a word about your views on retaliation: they are delightfully amusing to me. *O Sancta Simplicitas!* After having giving us three columns upon the iniquities and "evil of Protection," you indulge in 20 lines as full of condemnation of Free Trade as ever was penned by myself or any other Protectionist. I must quote some of them:—

"It is easy, though very unsportsmanlike, to find a man whose hands are tied behind him, and we are in the position of that man, unable to retaliate."

"Foreign countries have taken every advantage of this position to impose those harassing and damaging tariffs on some of our staple industries, some of which have been irretrievably ruined in consequence."

I must confess I have never written anything better than this in all my denunications of the follies of our so-called "Free Trade." However, I do not like the expression "unsportsmanlike." I do not think our foreign opponents care much whether their trade methods are considered "sportsmanlike" by us or not. But better is to come.

You were evidently alarmed after having written this paragraph; it so clearly points to the urgent necessity of introducing countervailing duties. This would be nothing more or less than "Protection." You realise that you could not have retaliation without Protection; in fact, the words are almost synonymous; and this is how you endeavour to extricate yourself out of such an uncomfortable position:—

"Let it be clearly understood among foreign nations that with what measure they mete to this country, it shall be measured to them . . . . and the necessity for retaliation will soon be largely removed."

That is what I call diplomacy (of the losing kind), which certainly is not business. You want to substitute the threat of retaliation for the real article, viz., the imposition of duties. This is the weapon that Mr. Chamberlain asks for; but your plan "won't wash." You would be the laughing-stock of the Germans and Americans even more completely than you Free Traders are now. Take my advice, and do not play with the fire of "Protection." There is no middle course, no compromise; you must either be the "Free Trader" out and out or the "Protectionist." Do not try to be a "Retaliationist" or a Fair or Freer Trader. "Free Trade" must either stay in its complete and unadulterated form or go; it is a religion, a fetish, a ghost. If adversity comes, you must still believe and say, "Allah is great." You must never doubt it in the smallest degree. Above all, so say your High Priests, you must not inquire, for inquiry is a deadly sin. Once challenged, Free Trade, like a spectre, will vanish. You have practically challenged a spectre. You have (though reluctantly) admitted many of its faults and disadvantages.

You grant that this country, which under Protection used to be the manufacturers of the world, "has to go abroad for the equipment of some of our largest undertakings."

You grant that money goes out of the country to buy all those articles which we can make ourselves (although, according to you, not so cheaply).

You grant that quantity pays, and you do not deny that the selling of quantities depends upon the markets we can sell in.

You grant the dumping process directed against our staple and other industries, "some of which have been irretrievably ruined."

You grant that *universal* Free Trade is the ideal condition, and you do not deny that during our Free Trade period, walls of tariffs are being built up against us, and we are receding further and further from that ideal condition.

You grant that we are greatly handicapped, that "we have to fight with hands tied behind us"; and that "we have offered the other cheek to the smiter, which he has not hesitated to strike."

But, you ask, "Is there *no* reply?" You certainly give that reply; throughout your article you give it directly or indirectly. It is, I acknowledge, the *only* reply to give. And these are your words:—"The purchase of all foreign electrical machinery has been a boon to the purchaser."

Answering Mr. W. H. Wilson, with reference to the printer who bought a foreign-made motor 70 per cent (*sic.*) cheaper than the English, you say:—"The printer is £70 better off."

You say, again:—"The buyer pays as usual;" "The purchaser has to come in and pay for all." This is your answer, and this is the sole reply of Free Traders since the time of Cobden.

If this be a true and good answer, something might be said in favour of Free Trade, and in mitigation of the enormous disadvantages to which Free Traders are exposing our country.

I propose to prove to you that your answer is not a good one, that it is fallacious in its theory and in its actual working.

But I have already trespassed on your space for this week. What I have to say is of some length, and requires deliberation in writing. Therefore, with your permission, I will conclude in your next issue.

**G. Byng.**

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### Electrically-driven Road Vehicles.

In your leader of June 26th you call attention to the comparatively small audience attracted by my short paper at the recent engineering conference on the "Applications of Electricity to Driving Carriages in Towns."

Personally, I was not surprised at the small attendance, as these conferences took place at a very inconvenient hour for most central station engineers, who are really those most interested in studying and forwarding this development of the use of electrical energy. I think, however, a good many of them are fully alive to the necessity of this, and I believe that during the next few years we shall see that electrically-driven vehicles will, for town purposes, take a leading position for street traffic.

In the few minutes given to me to reply on the discussion, I was quite unable to do justice to most of the important points on which future success depends.

The advances that have been made in other forms of automobilism, first with the petrol-driven, and second with the steam-driven car, have paved the way for the advent of electromobiles. The petrol cars have encouraged a taste for travel, *i.e.*, have enabled town dwellers to get into the country and enjoy themselves by seeing the beauties of the home counties. At first the majority of motor-cars were used for this purpose, but these pleasure cars were found so convenient for business purposes that their use has rapidly extended as a rapid means of communication in the streets of towns in spite of several disadvantages such as noise, smell, escape of steam and similar matters. As soon as a few properly equipped electromobiles were put on the streets it was seen what important advantages they offered for town traffic. Their freedom from any of the above objections, and, in addition, the ease with which they can be managed by unskilled persons, has put them into a different category from the ordinary motor-car, which requires that the owner should pay a skilled attendant. I am certain that so long as such skilled attendance is necessary, the motor-car will continue to be a luxury, or when used for commercial purposes its use will be confined to large establishments, but as soon as we can produce electromobiles either for private or public passenger transit in town or for public or private carriage of goods, the demand for them will become enormous, provided that the cost of upkeep will compare at all favourably with the cost of horse-drawn vehicles.

One of the things that I hoped that the discussion on my paper would bring out very clearly is that the electromobile in its present form only requires careful management in one point, that is, as regards the care of the accumulators, and that in our present state of knowledge all that is necessary to deal with this defect is, that the users should have as little to do with the charging, care, and upkeep of the accumulators as possible; in other words, that the future of electromobilism is at present solely a question of the establishment of suitable organisations for the furnishing at many charging centres of properly charged accumulators, which can be readily put into any vehicle at a few minutes' notice. In order to do this it is evident we must decide on standards, that is to say, we must standardise the size, weight, power and E.M.F. of the boxes of accumulators that are necessary to drive these vehicles, and I am glad to say that since my paper was read the Engineering Standards Committee have decided to form a sub-committee for this very purpose with Mr. Worby Beaumont, whose knowledge of automobolism of all kinds is second to none, as its chairman.

**R. E. Crompton.**

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### "Lighting."

Under the above title, a letter from the pen of Mr. J. T. R. Wilson appeared in the *Scotsman* for May 18th last, and I enclose herewith a cutting from that paper, in the hope that you may be able to find room in your valuable paper for at least a short extract. So far as I am aware, no comments on Mr. Wilson's letter have been published, but as his figures and statements are so very much in favour of gas for street lighting, I think, in the interests of the public, it would be unfortunate if the results he has arrived at were allowed, in their present form, to pass as unquestionable facts. It is, however, most difficult to criticise these results, as no details are given as to how the candle-power and maintenance figures are arrived at. I should therefore be glad if Mr. Wilson would give us full details.

His results, backed by these details proving them to be correct, would form a most valuable contribution to the, at present, much too meagre information available on so important a subject as comparative street lighting. On the other hand, if convincing proofs of the accuracy of the results are not forthcoming, Mr. Wilson's enthusiasm in favour of gas lighting will, I am sure, not be shared by many.

It will be understood that I am not referring to the street lighting of any one particular town or city, Edinburgh, for instance, but to the broader subject "street lighting generally," which Mr. Wilson includes in his letter.

The figures given in the *Scotsman* are so much in favour of gas that in connection with Mr. Wilson's statement to the effect that "he is convinced that street lighting by means of arc lamps is out of date," one is constrained to ask, "Are his figures the result of his conviction, or his conviction the outcome of reliable data obtained by careful and accurate experiments?"

To go through all the points in the letter would, I am sure, take up much more of your valuable space than you can spare, but I should like to call attention to the following:—

1. The candle-power and maintenance figures, from which the cost per C.P. of gas and arc lamps can be obtained, require considerable explanation.

2. It is unfair to assume that a 350-C.P. gas lamp is as good as a 500-C.P. arc lamp for the purpose in question, especially when it is remembered that for a well-lighted street, candle-power at the street surface is not the only desideratum.

3. The table showing the progress of gas lighting could, without much difficulty, be supplemented by another showing the progress of street lighting by electricity, the results being even more startling in view of the fact that the latter illuminant has very frequently to compete with gas, for which the mains and connections are already laid and made.

I would also like to draw the attention of your readers, many of whom are no doubt interested in this subject, to your issue of March 20th last, in which appeared an abstract of various reports made on street lighting in the City of Westminster, by Mr. J. W. Bradley, the City engineer. May I ask Mr. Wilson to kindly give details similar to those given in these reports?

In conclusion, let me add that the marked improvement in gas lighting which has been effected during recent years must be—and, I think, is—acknowleged; and my only excuse for trespassing on your space is my desire that the whole truth relating to such matters as the one in hand should, in the interests of all concerned, be published.

**A. J. Hodgson.**

Chelmsford, *July 20th*, 1903.

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### Mr. Snell's Presidential Address.

I cannot allow the leader in your current number to pass without calling attention to a misquotation from my recent address to the Incorporated Municipal Electrical Association. I do not admit "that I feel the disadvantage of municipalities whose governing powers are limited to certain defined areas undertaking business . . . . which can be most successfully worked over districts embracing the areas of numerous local authorities" (in other words, by power companies). What I did endeavour to express was the unfair disadvantage imposed upon municipalities by the

present financial regulations. I said nothing at all about the restriction of area.

But it is your *partial* extract from my address of which I have more to complain. I commenced a paragraph with these words: "All municipal electrical undertakings should be granted a period of 42 years for the repayment of loans. Each application for a loan should be subjected to an inquiry of the Board of Trade . . . . and it should be compulsory upon the municipal authority to set aside an additional sum (over and above the sinking fund thereby entailed) of 1½ per cent. of the value of the capital expended, commencing not later than two years after such expenditure had been made to form a depreciation fund."

Now, you have carefully left out the first portion of this paragraph, and have commenced your reference at the words "each application for a loan, &c.," ingeniously extracting my advocacy of a depreciation fund, and absolutely omitting any reference whatsoever to the extension of the period for repayment of loans. Is this quite fair? It is a misquotation, for the reason that an essential factor is omitted; and your partial extract from my address is an unfair misrepresentation of my views, which I cannot allow to pass.

**John F. C. Snell.**

[We regret that Mr. Snell regards our treatment of his address as unfair. The first passage was an inference, not a quotation—still less a misquotation; in the second, we showed that Mr. Snell accepted the sound principle of allowance for depreciation, which has nothing to do with repayment of loans, and we welcomed his statement as being in substantial agreement with our own contention. Moreover, the address was printed almost *in extenso* in our issue of July 10th.—Eds Elec. Rev.]

### Fuse Wire.

My attention as been drawn to a letter appearing in your journal of the 10th inst. from Mr. N. C. Woodfin *re* Fuse Wire. Mr. Woodfin gives some figures proving the unreliability of fuse wires as commonly supplied.

My firm has made a large number of tests of wires and strip, and we can fully bear out his figures. In fact, we have found a still greater difference between the actual fusing point and that at which they were rated. In addition we found that there was no fixed standard to which we could work.

Two years ago we were experimenting with wires and strip, and we have for some time supplied fuses, wires and strip which have been calibrated and tested and are guaranteed. We have prepared tables plotted in the form of curves, showing the varying points of fusing for different distances between terminals, which Mr. Woodfin might wish to examine.

**W. Macdonald.**

London, *July 28th*, 1903.

### Development of the Current Interrupter.

The writer of the article on "The Current Interrupter" and others state that the Wehnelt break may be used on an alternating current circuit.

This is *not* the case, for, if so used, the platinum tip is rapidly disintegrated, and the particles torn off, collecting in a sludge at the bottom of the vessel. Moreover, the coil, being so worked, will give only from 25 to 50 per cent. of the spark-length obtainable when using continuous current.

Again, except, perhaps, when using low pressure laboratory currents, interrupter tips made of ebonite, fibre, rubber, &c., are absolutely useless; they must be made of glass, porcelain, lava, or some like substance (Electrical Review, Vol. 49, page 789).

The action of the break appears to be purely mechanical, and the dispensing with the ordinary condenser is not due to any capacity at the terminals of the interrupter (though some have used this as an example for resonance), but to the extremely sudden break caused by the explosion of the gases round the anode.

**Mortimer Codd.**

London, *July 28th*, 1903.

Constant Reader.—Apply to Mr. C. P. Elieson, of 75, Edith Road, W., for information regarding this battery.—Eds.

Driver Quick Stop is informed that his letter cannot be published unless his name and address are furnished to us, for our private information.—Eds.

## BUSINESS NOTES.

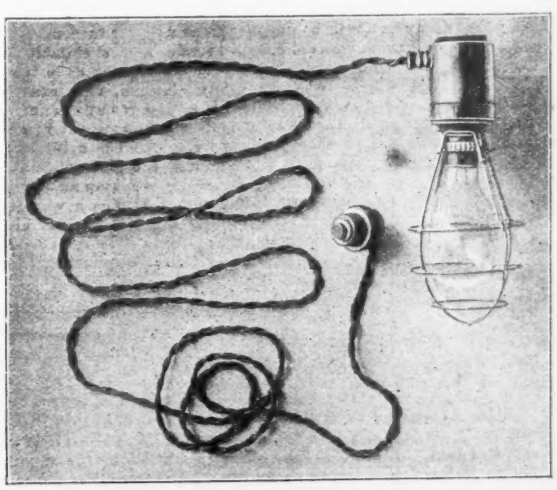
### Electrical Wares Exported.

| Week ending July 29th, 1902. | | Week ending July 28th, 1903. | |
|---|---|---|---|
| Alexandria Teleg. mat. | Value £580 | Amsterdam .. .. .. | Value £119 |
| Buenos Ayres .. .. .. | 1,703 | Bombay .. .. .. .. | 138 |
| Calcutta .. .. .. .. | 1,462 | Buenos Ayres .. .. .. | 49 |
| ,, Teleg. instruments .. | 1,053 | ,, Teleph. mat. .. .. | 237 |
| Cape Town .. .. .. .. | 41 | Calcutta .. .. .. .. | 479 |
| Christchurch .. .. .. | 141 | Cape Town .. .. .. .. | 873 |
| Christiania. Teleg. wire .. | 45 | Colombo .. .. .. .. | 73 |
| Colombo .. .. .. .. | 3,932 | Copenhagen. Teleg. cable .. | 950 |
| Copenhagen .. .. .. | 3,080 | Delagoa Bay .. .. .. | 64 |
| ,, Teleg. mat. .. | 78 | ,, Teleg. apparatus | 160 |
| Durban .. .. .. .. | 522 | Durban .. .. .. .. | 1,422 |
| ,, Teleg. mat. .. .. | 1,363 | ,, Teleg. mat. .. .. | 47 |
| Fremantle .. .. .. | 30 | East London .. .. .. | 364 |
| Grenada. Teleg. mat. .. | 86 | ,, Teleg. mat. .. | 332 |
| Hamburg. Teleg. cable .. | 25 | Flushing .. .. .. .. | 12 |
| Hong Kong .. .. .. .. | 158 | Gibraltar .. .. .. .. | 122 |
| Larache .. .. .. .. | 824 | Gothenburg. Teleg. mat. .. | 24 |
| Madras .. .. .. .. | 7 | Launceston .. .. .. .. | 17 |
| Melbourne .. .. .. .. | 147 | Lisbon .. .. .. .. | 47 |
| Nagasaki .. .. .. .. | 70 | ,, Teleg. mat. .. .. | 276 |
| Naples .. .. .. .. | 210 | Madras .. .. .. .. | 141 |
| Ostend .. .. .. .. | 370 | Malta .. .. .. .. .. | 10 |
| Perth .. .. .. .. | 1,061 | ,, Teleg. mat. .. .. | 48 |
| Port Elizabeth .. .. .. | 1,500 | Ostend .. .. .. .. | 30 |
| Rotterdam. Teleg. wire .. | 35 | Paris .. .. .. .. .. | 1,304 |
| Shanghai .. .. .. .. | 174 | Perth .. .. .. .. .. | 69 |
| Sydney .. .. .. .. | 376 | Port Elizabeth .. .. .. | 110 |
| Tientsin .. .. .. .. | 89 | Rotterdam .. .. .. .. | 38 |
| Valparaiso .. .. .. .. | 49 | Samarang .. .. .. .. | 10 |
| Vera Cruz .. .. .. .. | 8,535 | Shanghai .. .. .. .. | 201 |
| Yokohama .. .. .. .. | 106 | ,, Teleg. mat. .. .. | 102 |
| | | Singapore .. .. .. .. | 67 |
| | | ,, Teleg. mat. .. .. | 39 |
| | | Sydney .. .. .. .. | 39 |
| | | ,, Teleg. mat. .. .. | 1,227 |
| | | Wellington .. .. .. .. | 123 |
| | | Yokohama .. .. .. .. | 340 |
| Total .. | £27,801 | Total .. | £9,703 |

### Foreign Goods Transhipped.

| | | | |
|---|---|---|---|
| Gothenburg. Elec. apprts. | Value £15 | Cape Town. Elec. apprts. | Value £278 |
| | | ,, Telephones .. | 1,193 |
| | | Total .. | £1,466 |

**An Electro-magnetic Support for Lamps.**—The Manufacture Générale d'Outillage, of Lille, has recently put upon the market an electro-magnetic lamp support for continuous current which, although very simple, seems likely to be of great service, particularly in workshops. This support is fitted with an electro-magnet which is excited by the current that feeds the lamp; the two bars fixed to the base of the socket are, in consequence, powerfully magnetised; the support can, therefore, be fixed to any piece of ironwork instantaneously, and in any position whatever. This is a great convenience, as, in many operations, it is important to

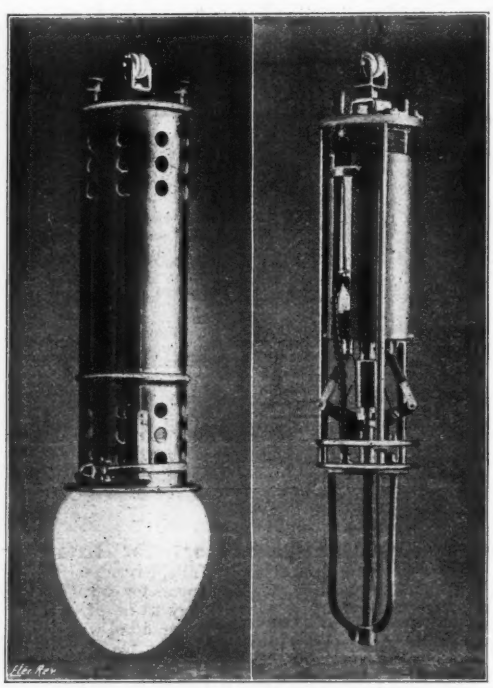


An Electro-Magnetic Support for Lamps.

have the light as near as possible to one's work, and, as a rule, this is not practicable. Moreover, it is inconvenient, and often dangerous, to hold a lamp in the hand in order to carry out work in dark places. The magnetic support does away with all these inconveniences; the workman fixes the electric lamp to any piece of ironwork, and his movements are then unhampered. This new invention seems, therefore, well suited to factories and all buildings used for industrial

purposes, and will probably be of great service in the examining and cleaning of boilers. This support might also be used with advantage in railway workshops and in tramway depots, for the examination of electric cars, in shipbuilding yards, on board ships, in mines, &c. In short, it is an apparatus well suited to all workshops and workrooms where portable lamps are used, and where there is danger of fire.

**The "Liliput" Arc Lamp.**—The accompanying illustrations show views of the general appearance and mechanism of the Siemens "Liliput" patent arc lamp, which is intended for indoor use. It is a continuous-current lamp. It mechanism is very simple; for the regulating of the carbons it contains in place of clockwork a reliable movable clamping arrangement, which is not disturbed by vibration or even a hard knock. The lamp burns singly on 100—120 volts or two in series on 200—300 volts, and it is said to give without a globe a hemispherical light of 160 c.p., whereas with an alabaster globe it gives a light of 130 c.p. The power expended is claimed to be equivalent to 1—1·2 watts per c.p. The lamp burns for 16—20 hours, depending upon the number of times it is switched on and off. Special cored carbons are made by Siemens Carbon Works for this lamp (5 mm. diameter). The upper carbon is 7½ in. long, and will burn down to a length of



The "Liliput" Arc Lamp.

2½ in.; the stump can then be used again as a lower carbon. The steady burning of the lamp is claimed to render it most suitable for indoor use, as a dining room, drawing room, or even as a table lamp. Moreover, the carbons are easily changed, and can be attended to by any ordinary domestic. It also burns satisfactorily in tramcars and railway carriages, and its size is a special recommendation for its use in shop-window lighting. The cylindrical cover of the lamp has a diameter of 2½ in. and the globe of 3¼ in.; the length is 12½ in. The nickelled hood gives the lamp an attractive appearance. A number of special indoor fittings have been designed, such as brackets, standards, pendants, &c., also shades for using with the lamps. The "Liliput" lamp is being placed on the market by the Siemens Electric Appliances, Ltd., of Watling Street, E.C.

**Holidays.**—The latest holiday hand-book to be issued by the Great Eastern Railway Co. describes the attractions possessed by a "Holiday in the Eastern Counties." It is got up in the same interesting style that characterises all the other pamphlets of the series.

**South African Trade.**—Owing to the interest now being taken by the general public in South African affairs, Messrs. P. S. King & Son are about to issue a cheaper edition of the reports prepared by the Trades Commissioners on Engineering, Textile, and General Trades. The Engineering report will be 7s. 6d., and the Textile and General trades reports 5s. each.

**Books Received.**—"Syllabuses and Lists of Apparatus applicable to Schools and Classes other than Elementary; Board of Education." London: Wyman & Sons, Ltd., Fetter Lane, E.C.

"Report of the Annual Meeting," held June 24th. The Industrial Freedom League, 53, Parliament Street, S.W.

"The Conflict over Municipal Trading." Lecture by Hon. Robert P. Porter at the London School of Economics, on March 13th. Industrial Freedom League, 53, Parliament Street, S.W. Price 2d.

**Liquidation.**—The Electric Tramways Trust, Ltd., is winding-up voluntarily, with Mr. Leslie Morse, 32, Queen Victoria Street, E.C., as liquidator.

**Trade Announcements.**—Messrs. Royce, Ltd., have now completed and started up the new works which they have erected at Trafford Park, Manchester, for the manufacture of dynamos and motors in quantities. The works, which cover a large area, and include a fully equipped iron foundry, are electrically driven throughout, have been expressly designed with a view to promoting rapid and economical production, and are equipped with the latest automatic and other machine tools and labour-saving devices. The resultant economy in the manufacture of standard lines of machines has been such as to enable the firm to considerably reduce their prices.

Messrs. Fenner James & Co., Ltd., have purchased the business of Fenner James & Co., of King's Cross. An announcement respecting the business is made in our advertisement pages to-day.

**Bankruptcy Proceedings.**—Under the failure of Noel Francis Nalder, electrical engineer, &c., 19, Queen Victoria Street, E.C., the first meeting of creditors was held last week before Mr. G. W. Chapman, Official Receiver, at the London Bankruptcy Court. The statement of affairs shows total liabilities £10,218 5s. 10d. and a deficiency of £8,782 15s. 10d. It transpired that the debtor, who is now out of business, some nine years ago entered into partnership with Mr. H. T. Harrison, and they commenced business as electrical engineers at Trafalgar House, Mortimer Street, St. Martin's Lane. The debtor provided £2,000 or £3 000 capital; they traded as Nalder & Harrison for 18 months and then converted the business into a syndicate, registered as Nalder & Harrison, Ltd., which in turn was formed into a limited company styled Nalder & Harrison Construction, Ltd. The shares and debentures were issued only to friends, the public not being invited to subscribe thereto. The debtor was one of the managing directors, and after working for 18 months the company went into voluntary liquidation. Subsequently the debtor and a Mr. Hilton took over the electrical part of the company's business and formed another company, styled Nalder and Hilton, Ltd., which carried on business at Trafalgar Works, Bow Common. The debtor was managing director of that company until it was wound up. He has also acted as a director of other companies, and some 18 months ago he joined another person in a scheme to form a company to take over St. George's Hall. To loss in connection with that scheme and claims under guarantees given the debtor principally attributes his failure. In the absence of any offer the Official Receiver was deputed to wind up the estate in bankruptcy.

**Catalogues and Lists.**—Messrs. Geipel & Lange have brought out a new illustrated circular describing their Vulcan station testing equipment for measuring pressure, current, and resistance.

Some illustrated sheets of the "K.C." motor bicycles, 2½ and 3 h.p., have come to hand from Messrs. C. H. Cathcart & Co., of Salisbury Square, E.C.

Messrs. Bullers, Ltd., of Tipton, have sent us a copy of an illustrated circular giving a description of their Chambers's patent third rail insulator, with registered tripod foot; this insulator is made of highly vitrified porcelain, and is claimed to be both electrically and mechanically suited for railway electrification.

Mr. James Melling, of Dashwood House, E.C., has issued a price list of his adjustable self-opening screwing chuck.

A circular relating to "Eclipse" packing (Fisher's patent) has come to hand from the United Asbestos Co., Ltd.

From Messrs. John Gibbs & Son, of Liverpool, we have received an illustrated catalogue of their patent air propelling and ventilating fans. Prices and details are given of belt-driven and electric motor fans, the latter using the firm's patent dust-proof motor. Direct-current cabin fans are described, and a patent safety interlocking double-pole quick-break starting switch and resistance.

The Electric and Ordnance Accessories Co., Ltd., of Aston, are circulating some little booklets (12 pp., 5 in. × 2 in.), giving small sketches of some of their specialties, Stellite and Stellite things.

**American Electrical Exports.**—The value of the electrical machinery and apparatus exported from the United States during May last is returned at £162,010, as compared with £145,665 in the corresponding month of last year.

**Installation Contracts.**—Among the recent contracts obtained by Messrs. Mather & Platt, Ltd., are the following:—A combined multi-polar dynamo with Allen's engine; also switchboard, four motors from 25 to 40 b.h.p. each; motor-generator and lighting installation for Messrs. Lamb Bros.' saw mill, Bootle; a complete lighting installation, with gas engines, dynamos, accumulators, boosters, &c., for the Matlock Hydro; a multi-polar dynamo with Howden engine, 20 motors, varying from 5 to 40 b.h.p., with starting and controlling gear, for Messrs. A. M. Peeble's paper mills, Rishton; a multi-polar dynamo with Belliss engine, feed pumps and condensers, main switchboard, four motors and starters, for the Bleach Works of Messrs. Holywell and Co., Ltd.

**Outings.**—On Saturday, 18th inst., the employés of the London and South-Western Railway Co.'s Electrical Department, Eastleigh Works, went for their annual outing to Alresford, where dinner was served at the Sun. Afterwards various sports were engaged in until 6 p.m., when the company sat down to tea, at which Mr. A. Russell Walker, A.I.E.E., electrician, presided. A smoking concert followed.

**Belgium.**—La Société de la Fabrique Belge de Crayons Electriques, is the name of a company which has just been formed at Liège with a capital of £32,000, to manufacture arc lamp carbons. The Compagnie Internationale d'Electricité, of Liège, and the Nederlandsche Maatschappij tot Explortie van Hopfelts Booglamp-electroden are interested in the new undertaking.

**Annual Holidays.**—The Hart Accumulator Co., Ltd., closes its works from August 3rd until the 10th for the summer holidays.

The works of the Incandescent Electric Lamp Co., Brook Green, will be closed for the annual holiday, from Saturday, August 1st, at 12.30, to Monday, August 10th, at 8 a.m.

## ELECTRIC LIGHT AND POWER NOTES.

**Aberdeen.** — The E.L. Committee has agreed to recommend the Council to apply for additional borrowing powers in connection with the department, to the extent of £65,000.

**Bideford.**—Two companies, one being the Bideford and District Co., have given notice of their intention to apply for a prov. order to light the town. It was decided to discuss in committee the obtaining of a prov. order by the Council.

**Bo'ness.**—The T.C. has been advertising for the assistance of a consulting electrical engineer to advise respecting the carrying out of its prov. order. All applications have to be lodged with the town clerk by to-morrow.

**Bunbury (W. Australia).**—The electric light has been introduced into the town by Messrs. Splatt, Wall & Co., of Perth, W.A., on the understanding that the installation shall be run for six months by the contractors, after which the Corporation shall decide whether it will purchase the plant or allow the company to run it. In the latter event the Corporation will have the right to purchase at the end of 7, 14, or 21 years. The plant consists of two Paxman "Economic" boilers, with Worthington feed pumps, and two Sturtevant engines, running at 325 r.p.m., and coupled direct to Sturtevant dynamos of 50 KW. each. The supply is on the three-wire system, and the town is lighted with arc and glow lamps. The overhead mains comprise about 17 miles of cable.

**Chester.**—On the matter of supplying energy to the sewage department for pumping, after full explanation and consideration of the figures, the committee resolved:—"That the Sewering Committee be offered the supply of energy required at the rate of $\frac{3}{8}$d. per unit for the first 100,000 units per annum, and of $\frac{1}{4}$d. per unit for all over the first 100,000 units per annum." It was complained that this was unjust to the Tramways Committee, who are charged $1\frac{3}{4}$d. per unit at the lighting station. Others pointed out that a 1d. of this latter amount represented capital outlay for the purpose of supplying the trams. In this case an overhead transmission cable, costing £200, will be required, and energy supplied during light load.

**Croydon.**—At the monthly meeting of the County Council on Monday evening last, the recommendation of the Electricity Committee for carrying out a scheme of additions and extensions to the generating station, at a total cost of £70,950, suggested by the borough electrical engineer (Mr. J. Gray Scott), came up for further consideration. After considerable discussion, it was decided to sanction the sum of £27,975 for the more pressing portions of the scheme. A sum of £10,000 will have to be borrowed this year. When the works covered by the £27,975 are completed, the Committee will ask the Council to sanction the balance of the £70,950.

**Dorchester.**—The Electric Lighting Committee reported that as the proposed cost of the power station with gas plant, machinery, cables, and arc lamps for the installation of the electric light over the compulsory area was so excessive, it had adjourned the further consideration of the question for the attendance of the electrical engineer. A deputation from the newly-formed Ratepayers' Association was admitted, and urged the Council to abandon the scheme, also asking that if it undertook electric lighting it would make the users pay, and not make up any deficiency from the rates.

**Gainsborough.**—The Council has decided to apply for a prov. order to supply the district with electricity, and a committee has been appointed, with full power to assist the clerk and engineer to prepare a scheme and serve the statutory notices.

**Goole.**—The U.D.C. has received a letter from an Electric Lighting Co., giving notice of its intention to make application for a prov. order to supply electricity within the Council's area, but the Council has decided to interview the Board of Trade at an early date, and to urge upon the Board the necessity of a definite extension of time being granted to the Council.

**Gravesend.**—The Town Council has entered into an agreement with the Brush Electrical Engineering Co. for that company to supply customers on hire or on the hire-purchase system with continuous current motors. The L.G.B. has authorised a loan of £9,580 for electrical extensions, and £2,000 for a dust destructor.

**Holyhead.**—On Monday the U.D.C. received the sanction of the B. of T. to the borrowing of £16,000 for electric lighting purposes.

**Hoylake and West Kirby.**—Application is about to be made by the U.D.C. to the L.G.B. for sanction to the borrowing of £324 for the erection of a water softening plant at the electric supply works. The L.G.B. is about to hold an inquiry respecting the application of the Council for sanction to the borrowing of £5,435 for extensions of the electric lighting plant.

**Leith.**—The revenue of the electricity department for the year was:—For private lighting and motor power, £8,250 13s. 4d.; public lighting, £4,932 7s. 6d.; other sources, £671 1s. 7d.; total, £13,854 2s. 5d. This has been sufficient to meet all working expenses and interest and instalments of loans and to leave a surplus of £1,120 15s. 2d. In the previous year the net loss on the undertaking was £188, so that it had improved this year to the extent of £1,308.

**London.**—STEPNEY.—Owing to the increasing demand for electricity the B.C. are considering a proposal to erect a second generating station and dust destructor on Blyth's Wharf, Limehouse, which was recently purchased by them.

CHELSEA.—The Law and Parliamentary Committee reported that they had considered the letter from the Clerk to the County Council, stating that the Highways Committee had had under its consideration the provisions of the Supply of Electricity Bill, recently introduced into the House of Lords by Lord Wolverton; that he had been directed to call the special attention of the Councils of the Metropolitan Boroughs to certain clauses of the Bill, by which it is proposed to confer upon the Board of Trade certain powers which would apparently reduce to some extent the control given to the local authorities by the Electric Lighting Acts, 1882 and 1888, and asking to be informed of the views of the B.C. with regard to the provisions of the Bill. The Committee was of the opinion that the interests of the borough are not likely to be prejudicially affected by the Bill.

SOUTHWARK.—The General Purposes and Finance Joint Committee reported that the district auditor had disallowed certain charges, thereby leaving the whole deficiency of £3,943 6s. on the electric light undertaking as a charge upon the rates of the parish of Newington, because no part of the expense incurred under the Act relating to the supply of electricity in the parish of Newington, a part only of the borough, could lawfully be charged upon the general funds of the whole borough, and because such expense should be borne by the area to which the adoptive local or other Act in point extended. The Committee was of opinion that considerable difficulty would arise hereafter if the undertaking were treated as a parish and not a borough concern, and therefore recommended that an appeal be made to the Local Government Board against the disallowances of the auditor, and that in the event of the appeal failing, application be then made to the London Government Act Commissioners to issue a scheme making the expenses of the undertaking chargeable to the whole borough.

BERMONDSEY.—The E.L. Committee reported that the land at Bull Head Dock—the Council's Rotherhithe depôt—which was thought to be suitable for the erection of a sub-station for the generation of electrical energy, was not sufficient for the purpose. There was land adjacent in the possession of the L.C.C., but as the B.C. did not wish to purchase land, the Committee had engaged Messrs. Kincaid, Waller & Manville to report upon the possibility of extending the present station, and so avoiding the necessity of erecting a sub-station at Rotherhithe.

CAMBERWELL.—In a report issued on Saturday by the B.C., it was stated that the following authorities had agreed to support the action of Camberwell in calling the attention of Parliament to the refusal of the Board of Trade to grant the application of the London Electric Supply Corporation for a provisional order over the whole borough:—Hammersmith, Doncaster, Eastbourne, Southampton, Bermondsey, Bodmin, Barrow-in-Furness, Shoreditch, City of London and Hastings. The L.C.C. wrote:—"The Council has always been in favour of two companies being allowed to compete in the same area, but it has always considered that any application by a company for an order, in respect of an area for which the local authority has been granted an order, should be refused. It appears to the Highways Committee that the action of the Board of Trade in the present instance is to some extent a departure from the attitude generally taken up by it in the past. The Committee is in sympathy with the Borough Council in the matter, but it does not appear that the Council has any power to render assistance with regard thereto, as under Sec. 4 of the Electric Lighting Act, 1882, the Board has a discretionary power to grant a provisional order authorising any local authority, company or person to supply electricity for public or private purposes within any area, and there is no appeal against the decision of the Board."

WANDSWORTH.—A lengthy report was presented by a special committee to the B.C. on the unsatisfactory lighting and the high prices charged. The former had been modified, but the alleged excessive charges continued, and the committee considered the only remedy was by competition. Without committing the Council to any scheme, it asked for leave to make further investigations, and with this end in view, recommended that Mr. Adams be empowered at a cost of £105 to draw up a complete scheme for the supply of electricity generated by power obtained from the dust destructor, to such districts of the borough as he considered advisable. The report was adopted. Subsequently, the General Purposes Committee reported that it had received a letter from the London Electric Supply Corporation offering, if they obtained a provisional order, to supply customers at 6d. per unit

for the first 4,000 units in each year, and 4d. per unit in excess of 4,000, with reductions for large orders. It was resolved to inform the company that the Council could not support their application unless they undertook to supply energy for lighting purposes at a flat rate of 4½d. per unit to private consumers, and 2d. per unit for power.

Marylebone.—A short time ago the London County Council, upon the recommendation of its Finance Committee, resolved not to grant the application of the B.C. for sanction to the borrowing of £1,274,000 for the purchase of that portion of the undertaking of the Metropolitan Electric Supply Co., Ltd., which is within the borough, under the award of the arbitration. Since communicating their decision a letter has been received from the Parliamentary agents asking whether, if the B.C. obtains a license from the Board of Trade under the Electric Lighting Act, 1882, to supply electricity within the borough, this will remove the legal objection to the Council sanctioning the loan. Mr. Haldane, K.C., M.P., has advised that if the proposed license is obtained from the Board of Trade, the B.C. will obtain such legal power to borrow as will justify the Council in sanctioning the borrowing. Inasmuch, however, as the maximum period for which the B.C. can be authorised to supply electricity under such license is seven years, Mr. Haldane advises that the period for the repayment of the loan should be limited in the first instance to the period of the license. After having completed the purchase and after the Board of Trade has fixed the date of the commencement of the St. Marylebone Electric Lighting Order, 1901, the Council will be in a position to vary its order sanctioning the borrowing by extending the period for repayment of the loan thereby authorised. The Finance Committee now report that this matter had been attended by many difficulties. The acquisition of the undertaking, however, had been rendered compulsory by Act of Parliament, and the purchase price had been determined by arbitration. In these circumstances the Committee recommend that counsel's opinion should be communicated to the Borough Council.

Hackney.—The B.C. has decided to reduce the price charged for electrical energy for power purposes from the flat rate of 2d. per unit to the following:—For the first 1,000 units per quarter at any one premises, 2d per unit; all consumption in excess of 1,000 units per quarter at any one premises, 1½d. per unit.

**Metropolitan Asylums Board.**—At the recent meeting of the Metropolitan Asylums Board the Works Committee reported that, as the result of further correspondence between the engineer to the Board and the County of Surrey Electrical Power Distribution Co., the company had agreed to supply alternating current at 200 volts at a reduced cost of 2½d. per unit to the Southern Hospital, the company supplying to a transformer chamber at the entrance gates. On the recommendation of the Committee, the offer was accepted.

**Newton.**—The U.D.C. has decided not to give their consent for the laying of electric lighting cables in Kingsteignton.

The Urban Electric Supply Co. has given notice to the Council of its intention to apply for a prov. order to supply electricity in the town.

**Potchefstroom (South Africa).**—The Government has decided to at once take steps to provide a municipal scheme for electrically lighting the town, and tenders will be immediately called for the work. The scheme will be rushed through in view of the activity of a private company, which proposes to lay down plant to supply the hotels and the business part of the town.

**Radstock.**—The Western Electric Distributing Corporation are applying for a prov. order enabling them to take power from the Somerset Electric Power Co. and distribute it within the urban district. It was decided to obtain the terms proposed to be charged by the company to consumers, and, if satisfactory, the Committee recommended the Council to support the company in their application for the prov. order.

**St. Annes.**—The annual return of the Electricity Department shows that, during the year ended March 31st, 179,190 B. of T. units were generated. A net profit is shown on the year's working of £94 18s. 4½d., against £12 7s. 5d. the previous year. The sum of £698 13s. 4d. was repaid on loans account, and £790 16s. 8d. for interest. The total amount borrowed is £37,405.

**Slough.**—The solution of the local E.L. question is of importance in its bearing on future schemes. The main problem was whether the Slough Urban District Council, having transferred by deed their E.L. prov. order to a company, the Slough and and Datchet Electric Supply Co., could then make an agreement under which they would pay compensation for compulsory purchase and for goodwill should they decide to acquire the undertaking after a certain number of years. The objection being taken that, under Section 2 of the E.L. Act, 1888, such a proceeding was forbidden, the opinion of the Board of Trade was obtained, which was to the effect that the Board saw no objection to the proposed agreement. Some members of the Council still doubting the legality of such a course, a further letter to the Board of Trade was sent, asking "how the Board of Trade reconcile the approval of the deed providing for payment by the local authority to the E.L. company for goodwill and compulsory purchase with Section 2 of the E.L. Act, 1888, which expressly provides that no such payment shall be made, seeing that no provisional order has been made, or is proposed to be made, under Section 3 of the same Act?" In their reply the Board "point out that the terms of purchase provided by Section 2 of the E.L. Act, 1888, relate to purchase after the expiration of a period of 42 years or such shorter period as is specified in that behalf in a prov. order, while the terms of purchase provided by Article 3 of the deed of transfer, are terms which have been agreed upon between the District Council and the transferee company, and relate to the purchase, after the expiration of a shorter period than that specified in Section 2 of the Act of 1888." The Board add that they "were advised that it was quite competent for them to approve the deed containing, as it does, special terms of purchase, as agreed between the parties." A lengthy discussion took place at the Council meeting upon this, and in the end, looking at the circumstances altogether, it was agreed that the adoption of the deed of agreement should be formally moved, but that the motion, not being seconded, the agreement should be rejected. This plan being followed, the proposal collapsed.

**Sunbury.**—Edmundson's Electricity Corporation has approached the U.D.C. with regard to the supply of electricity to the town. They offer to extend their area, by means of a prov. order, to Sunbury, and to supply private consumers at 7d. per unit for the first hour, and 3d. afterwards, and not exceeding 2½d. per unit for public lighting. The Council has intimated that they are not antagonistic to the scheme.

**Tunbridge Wells.**—In reply to the request of the Tonbridge Board of Guardians for a supply of electricity to the Workhouse, at Pembury, the T.C. has replied that at present they had no power to lay electric mains outside the borough, but they were prepared to endeavour to obtain a prov. order to extend its lighting area so as to include the Workhouse.

**Turkey.**—La Société Ottomane des Mines de Karasson has applied for a concession to utilise certain available water power at Karasson in the generation of electrical energy for power purposes.

**West Ham.**—At a recent meeting of the Council the annual report of the electrical undertaking for the year ending March 31st, 1903, was submitted. The capital expenditure during the 12 months was £53,740, bringing the total up to £185,147. The revenue for the year was £24,902, as against £21,073 in 1902, while the working expenses in the same periods were £15,465 and £13,688 respectively. The net profit for 1903 was £2,503, as against a profit of £1,137 in 1902 and a deficiency of £2,499 in 1901. Of the surplus, £1,000 was carried to reserve fund, and the balance, £1,699, was retained in view of the rapidly increasing charges of the station at Canning Town now in course of erection. Last year the units sold were 1,930,563, at an average cost for private supply of 3·57d. and for public lamps of 1·39d. In 1902 there were 1,635,540 units sold at an average cost for private supply of 3·5d. and for public lamps of 1·07d. The report replied at some length to criticisms that adequate depreciation has not been charged to revenue account, and stated that the position adopted by the Council is in accord with the general practice throughout the country, viz., to charge to the revenue account the loan, repayment or contribution to sinking fund, the effect being to wipe out the loan debt within 25 years. The report and accounts were adopted. The electrical engineer (Mr. J. K. Bock) in his general report on the year's working, stated he had recently constructed a temporary apparatus to extract the oil from the discharge water from the condensers by means of which the consumption of town water had been reduced by 250,000 gallons per week, in addition to which the water is now returned to the boilers at about 140° F. temperature, and so a great saving in coal was effected. The total reduction on the two items was from £12 to £14 per week.

## ELECTRIC TRACTION NOTES.

**Birmingham.**—Following upon the refusal of Mr. Hamilton, of Leeds, of the appointment as general manager of the trams, the Committee approached several likely men, with the result that Mr. Alfred Baker, of the London County Council trams, has definitely accepted their offer. The amount of salary is not disclosed, but it is believed to be £1,500 per annum.

The Corporation is advertising in the local papers for tramway permanent way material, such as rails, poles, trolley wire and bonds. Apply to the City Engineer, Town Hall, Birmingham.

The King's Norton District Council, before coming to any definite decision with Birmingham, wish to consult an expert.

Negotiations with the Handsworth District Council are also in abeyance, as it has been found that part of the line connecting the Birmingham and Handsworth systems is in Aston Manor, and therefore under the control of the B.E.T. Co.

**Bromley.**—The Light Railway Commissioners held an inquiry into the application of the British Electric Traction Co., Ltd., for an order under the Light Railways Act, 1886, granting them powers to construct and work light railways in the Bromley urban and rural districts. After a hearing extending over several hours, it was proposed to adjourn for the day. Col. Boughey, the chairman, consulted his fellow-Commissioners, and said:—"We do not think we can carry this case any further. No evidence has been offered for the important part of the scheme north of Bromley South railway station, and, under all the circumstances, and having regard to the opposition indicated by the Urban District Council and the residents and others, we are not prepared to carry the application further."

**Dublin.**—A movement is on for the construction of a light railway or electric line from Dublin to Slane, a distance of 26½ miles. Already a considerable amount of the required £105,000 to construct the line has been guaranteed.

**Dumbarton.**—At an inquiry under the Private Legislation Procedure (Scotland) Bill, held in Glasgow last Friday, the preamble of a Bill to construct electric tramways in Dumbarton was proved. There was no opposition. The Electric Supply Corporation, Ltd., are the promoters of the Order, and the tramways are to be constructed in two years.

**East London Railway and Electric Traction.**—This railway, during the first six months of the year, had a falling off of 80,000 in the passengers carried, mainly owing to fewer local bookings. The chairman told his shareholders the other day that the only thing that they had to look to in the future for an improvement in the passenger traffic was the inevitable "electrification" of the line. At the present moment the leasing companies were not prepared to incur the necessary expense of making the change, but he could not help thinking that it would have to be undertaken before the "electrification" of the other lines was completed.

**Hamilton.**—The Hamilton, Motherwell, and Wishaw Tramways were officially opened on Wednesday last week, when passengers were carried over the entire system, extending from Blantyre to Wishaw, a distance of 8¼ miles. Half-mile stations at ½d. fares have been made throughout the route, while the whole distance can be traversed for 5d. The system was to be opened for traffic at the beginning of June, but owing to the generating station buildings subsiding in consequence of the mineral workings in the ground underneath, a delay took place. The station is not yet in perfect working order, but a supply of current is being provided by Motherwell T.C. Since the opening day so heavy has been the rush of passengers, that the resources of the company have been taxed to the utmost. The line passes through one of the most industrial and picturesque districts in the West of Scotland.

**Italy.**—Consul-General Keene reports that both Turin and Genoa are well furnished with electric tramways. In the former town there are 50 miles of rails. In Genoa there are 70 miles of rails and 153 cars, which made 1,559,813 journeys in 1902, covering 4,856,855 miles, and carried 31,378,687 passengers. The "Funicolari" with a track of less than a mile, and working four cars, made 103,862 journeys, covering 44,819 miles, and carried 395,864 passengers. At Spezia there are four miles of rails now open, and more under construction. There are six cars and two trailers which, since the date of opening the lines on July 22nd, 1902, have carried 401,000 passengers. Four new cars have recently been ordered.

**Keighley.**—The Tramways Committee has recommended that the borough engineer and the electrical engineer prepare all necessary plans, sections, specifications and estimates for reconstructing and electrically equipping the existing tramways (3 miles), and for the construction of a new electrical tramway from North Street *viâ* Cavendish Street and Bradford Road to Stockbridge (1 mile); and that application be made to the B. of T. for sanction to borrow the money necessary.

**Kilmarnock.**—The preamble of a Bill promoted by the T.C., to construct electric tramways in the burgh, was passed by the Parliamentary Commissioners, who held an inquiry under the Private Legislation Procedure (Scotland) Act, in Glasgow last Saturday. The Order was opposed by the Glasgow & South-Western Railway Co., and owners and manufacturers in the burgh. The entire cost of laying the lines and equipping them, is estimated at £45,000. The tramways are to be completed in three years' time.

**Leeds.**—Mr. J. B. Hamilton, Corporation tramways manager, has declined the invitation to take the position of tramways manager at Birmingham.

**Light Railways Bill.**—In the House of Lords on July 24th, Lord Wolverton, in moving the second reading of this Bill, said that when Parliament passed the Light Railways Act of 1896, it treated that measure more or less as of an experimental description, and confined its operations to the period of five years. Since the expiration of that period Parliament had renewed the Act year by year, and the object of the present Bill was to make it permanent, as the Board of Trade considered that it had been a success. This was the effect of Clause 1. Clauses 2 and 3 reformed the procedure. Under the existing Act if the Board of Trade thought a light railway scheme to be of such importance that it ought to be submitted to Parliament the preliminary work on the Order was wasted and the promoters had to begin *de novo*. Clauses 2 and 3 remedied that state of things. The Earl of Morley thought that the measure was a very useful one, but remarked that there was no doubt that the existing legislation in regard to light railways and tramways was not in a very satisfactory condition, and appealed to the Board of Trade to consider before another Session whether they should not introduce a more comprehensive measure which would bring some order into the law. The Bill was read a second time.—*The Times*.

**London.**—The Highways Committee reported to the L.C.C. on Tuesday that there had been several cases lately of persons maliciously inserting pieces of metal and wire in the conduits on the Westminster to Tooting tramways, the result of which had been to create short circuits, the tramway traffic being in consequence seriously interfered with. "This malicious interference with the conduit, in addition to hindering the smooth working of the tramways and causing numberless delays, is likely to endanger the safety of the passengers on the tramcars, and we have therefore arranged for the issue of a notice offering a reward of £25 to any person who may supply such information as will lead to the conviction of the offenders, and we hope that this course will effectually stop so dangerous a practice."

The electrification of the County Council tramway from Vauxhall to Camberwell Green is now completed. The level of the roadway has been raised 6 in., and on both sides of the metals the roadway has been paved with wood blocks, while the reflagging of the pavements is nearly completed. It is anticipated, says an evening contemporary, that in about a week the official Board of Trade inspection will be made, and thereafter electric cars will be run. Considerable progress has been made with the electrification of the tram systems from Peckham and Bermondsey New Road, along the Old Kent Road, to Greenwich.

**London, Brighton and South Coast Railway.**—In moving the report of the London, Brighton and South Coast Railway at the one hundred and fifteenth half-yearly meeting on Wednesday, Lord Cottesloe said the proprietors would be interested to know that the board was actively pursuing its inquiry into the subject of electric traction, and a committee of directors had been appointed for its special consideration. The problem was a very difficult one so far as that railway was concerned by reason of the complication of lines and the inter-mixing of main and local, or fast and slow, traffic, and it would be obviously wrong to revolutionise the present system of working by the introduction of a new method of locomotion until it was made absolutely clear that advantage both in greater rapidity of transit and greater economy and ease of working would result. Regard must be had also to the competition of other means of transport, and it was necessary for the board to be assured that electrical traction would be a success from its commercial as well as from its mechanical aspect. It was, therefore, advisable to proceed with caution and having every desire to arrive at a true conclusion; this was what the directors were doing. In conjunction with the London and South-Western Co., they were trying an interesting experiment with a self-contained steam motor-car on the branch line between Fratton and Southsea, and it was hoped that the result would be a saving in working expenses. The advisability of establishing similar working either by steam or electricity on other parts of the company's system was engaging the attention of the board.

**Manchester.**—The annual report of the working of the tramways was presented at Tuesday's meeting of the Tramways Committee. The aggregate length of single track open for traffic at March 31st, 1903, was over 77 miles. Whereas the sum available for disposal by the Committee at the end of the financial year of 1902 was only £63,456, the amount at the end of the financial year of 1903 nearly doubled itself, being no less than £126,566. Out of these totals, contributions were made in relief of the rates of £20,000 and £30,000 respectively. Figures are also supplied by the report, which show that the operating expenses per car-mile are being reduced. In 1901-2 the total spent under this head per car-mile was 8·10d., whereas it was only 6·95d. in the year ended March last. A total car-mileage of 6,382,036 was run between April 1st, 1902, and March 31st, 1903; the number of passengers carried during the year was 66,849,457; the receipts amounted to £306,249 15s. 8d., while the average receipts per car-mile were 11·52d. The Committee also had under consideration the whole of the tramways fares, and made some important alterations. The main principle carried out was to introduce between the 1d. and 2d. stages 1½d. fares, between the 2d. and 3d. stages 2½d. fares, and so on, according to the length of the routes. In addition to the 1½d. fare, the Committee introduced a 1d. fare for the middle of the first stage to the 1½d. stage.

**Melbourne Railways.**—The *Sydney Daily Telegraph* for June 16th, says that the Chief Commissioner of Railways (Mr. Tait), before leaving Canada, was asked by the Victorian Government to supply a report on the question of electric traction generally, and more particularly in regard to the conversion of steam railways to electricity. Mr. Tait commissioned Mr. R. B. Owens, professor of electrical engineering at the M'Gill University, to prepare a report on the lines suggested. Prof. Owens' report, together with an exhaustive one by Mr. Tait himself, have now been submitted to the Minister for Railways.

**Metropolitan Railway Co. and Electric Traction.**—The report states that for the half-year ended June 30th the British Westinghouse Electric and Manufacturing Co., Ltd., are making satisfactory progress with the building of the power station at Neasden, and the generating plant and machinery are well in hand. The sinking of the two wells has been completed, and prolonged tests show an ample supply of water to be available. A reservoir has been constructed adjoining the generating station for the storage of water and for condensing purposes. It will be completed in about a month, when it will be filled from the two wells. The new railway from Harrow to Uxbridge, connecting with this company's railway at the former place, is approaching completion, and is being equipped throughout for electric traction. In view of the capital expenditure required for the electrification and works in connection therewith, resolutions will be submitted at the special meeting providing for the creation of the capital authorised to be raised by the Metropolitan Railway (Various Powers) Act, 1884, and the Manchester, Sheffield, and Lincolnshire Railway (Extension to London) Act, 1893. These capital powers were not required for the objects for which they were originally authorised, and Parliamentary sanction has been given to their being applied to other of the company's purposes.

**Mid-Yorkshire.**—Last week Major Pringle, of the Board of Trade, inspected the new electric tram line from Nab Wood to Thackley, within the district of the Shipley Urban Council, and later in the day the line was opened for public traffic. The line is a little over two miles, and the company has fixed four half-penny stages.

**Reading.**—The Corporation electrical tramways were formally opened by the Mayoress on Wednesday afternoon last week. The generating station and car-sheds are in Mill Lane. The contractor for the buildings was Mr. A. Faulks, Loughborough, and the car-shed lay-out was the work of the Lorain Steel Co. There are three boilers of the Babcock-Wilcox type with superheaters and mechanical stokers, Green's economiser, and Weir feed pumps. The four main engines are of the vertical enclosed compound condensing type by Browett, Lindley & Co., developing 150 B.H.P. at 420 revs. per minute; they are direct-coupled to 500-volt generators by the British Westinghouse Co., who also made the switchboard. Four surface condensers are supplied by two electrically-driven centrifugal pumps. The contractors for the plant were Messrs. R. W. Blackwell & Co., Ltd. Tramways are constructed under Reading Tramways Orders, 1878 and 1899, and the Reading Corporation Tramways Act, 1900. The total amount sanctioned to be borrowed was about £214,000, including the purchase and reconstruction of the Reading Tramways Co.'s undertaking. There are about 7½ miles of route, over 5 miles being double, and over 2 miles single track, equivalent to 13 miles of single track. Girder rails are used, weighing 96 lbs. per yard; they have a 1½ in. groove. The bonds used are of the plastic, crown solid, and crown flexible types. Syke's conduits are laid for the reception of the cables. The special work, points and crossings were supplied by the Lorain Steel Co., of U.S.A., and Mr. Ed. Nuttall, of Manchester, was contractor for the permanent way. The site on which the power station and car-sheds stand in Mill Lane, adjoins the River Kennet. The engine room measures 75 ft. × 30 ft. × 37 ft. high; and the boiler house 64 ft. × 45 ft. × 48 ft. The chimney is of "Custodis" construction 150 ft. high. The car-shed provides accommodation for 30 cars. The overhead wire work, which was carried out by Messrs. Blackwell, consists of centre "bowstring" and side-pole bracket construction; a special feature being the practical absence of guard wires, as very few telegraph or other wires cross the tracks. The cars, which were supplied by Messrs. Dick, Kerr & Co., are of the top-seat type with "reversed" stairways, mounted on single Brill trucks, equipped with two 25-H.P. motors, and swivelling trolleys, "Stirling" brakes, and "Tidswell" life-guards. Destination boxes are fitted, and these are electrically illuminated at night. Each car seats 22 persons inside and 26 outside. The Board of Trade inspection of the lines took place on July 14th, and consent has since been received to the working of the tramways. The tramway engineers were Mr. John Bowen, borough engineer and surveyor, and Mr. J. E. Winslow, consulting engineer. Mr. Walter Binns has been appointed engineer and manager. The new tramway lines replace about 2½ miles in length of the old horse tramway company's system. The work of conversion to electric traction was commenced in March, 1902.

**Southport.**—A one-man car, made by the Brush Co., has arrived, and will shortly be put on the Southport Co.'s system from Birkdale to Southport. The driver will work the car single-handed. He will be able to take payments and give tickets.

**Wandsworth.** — The B.C., while adhering to their previous decision that the tramway through Garratt Lane must be constructed on the conduit system, have decided to inform the L.C.C. that they consent to overhead wires on the other lines.

**West Ham.**—On Tuesday night the Corporation, after a debate of two hours, fixed the working hours of the motor-men and conductors to be employed on the new lines at 60 per week. The Labour members strongly urged an eight-hours' day, but it was pointed out that out of 36 tramway municipal undertakings in the kingdom, the working hours in 27 were 60. It was stated that the line from Stratford to Canning Town and the Victoria Docks would probably be opened in October.

**Wolverhampton.**—Up to the time of writing nothing has been officially communicated to the Press as to the progress of the so-called negotiations between the Corporation and the Lorain Co. Another cable, however, has been received from America, and it is an open secret that the company have declined to accept the second offer of the Corporation. They prefer to abide the result of the arbitration proceedings, claiming that they have fulfilled their part of the contract, and that they are entitled to the full amount of £24,000 for the work they have done. It is at the same time stated that the company are willing to put the track in good order, and are prepared to give a guarantee that in the event of future extensions the cost of the electrical equipment on the Lorain system shall not exceed a certain amount. This, however, does not seem to carry any concession, for it will be remembered that the Corporation, on the advice of the electrical engineer (Mr. C. E. C. Shawfield), have all along contended that if the present length of line is taken over it should only be on condition that the electrical equipment is perfect as far as it is possible to make it.

## TELEGRAPH AND TELEPHONE NOTES.

**The Mercadier Phonic Multiplex Telegraph.**—Some fresh trials are shortly to take place with this system between Paris and Lyons over two copper wires. The apparatus has been largely transformed. The vibrating tuning forks have given place to a series of commutators producing alternating currents of a frequency varying from 500 to 1,000 per second. In place of using a special note of the gamut for each of the monophonic stations, they are distinguished by the vibration numbers. A motor driven by electricity carries on a prolongation of its axis a series of alternators and a fly-wheel and governor. Isochronism is obtained in a fairly precise manner by a concord of sounds between a tuning fork and the regulator of the fly-wheel, which, on one of its faces, is furnished with a series of cavities producing a sound varying with the speed of revolution. This concord is absolute in the regulating telephone only when the motor is rotating at the desired speed, and the speed is regulated by means of a rheostat placed between the source of energy and the motor. The vibratory currents pass into a transformer, and the induced currents on arrival pass through the series of monophones. The old system required the use of a telephone circuit arranged on the anti-induction principle; with the new system two copper telegraph lines suffice. The microphonic relays have also been dispensed with, and all the apparatus necessary for balancing. The sounds, too, are sharper, clearer, and stronger. The modifications seem to mark a considerable progress, and they are due largely to a young engineer associated with Mr. Mercadier in his work.

**Partition of the Pacific Cable Rate.**—On Monday last Sir Edward Sassoon asked the Postmaster-General if he would state in what proportions the rate of 3s. per word charged for a telegram from London to Sydney, *viâ* the Pacific cable, is divided up; how much of this sum is payable to the British Post and Telegraph Department, the Atlantic Cable Co. carrying the message, the landlines in North America, the Pacific Cable account, and the Government of New South Wales, respectively; whether such a message in its transit across North America passes only over Canadian landlines; or if, for a part of the way, landlines through the United States are employed, what proportion of the 3s. is paid for transit over these; will he say, further, whether the service indications on such messages are charged for by the Atlantic Cable Companies; and, if so, what proportion of the cost does such charge amount to on a message of, say, five words from London to Sydney; and whether all unrouted messages from Great Britain and Ireland, destined for Australia, handed into a Government telegraph office, are preferentially passed on to one of the pooled Atlantic Cable Companies; and, if so, to which?

In reply, Mr. Austen Chamberlain said:—The sum of 3s. charged on a telegram from this country to Sydney is divided as follows:—

| | s. | d. |
|---|---|---|
| Atlantic Cable Co. ... ... ... | 0 | 8 |
| Landlines in North America ... ... | 0 | 4 |
| Pacific Cable Board ... ... ... | 1 | 7 |
| Australian Government ... ... | 0 | 5 |

Out of the sum of 8d. accruing to the Atlantic Cable Companies, the Post Office is paid the ordinary inland rate in respect of such telegrams as are dealt with at postal telegraph offices. In respect of telegrams dealt with entirely by the companies, no payment is made to the Post Office beyond the rent which the companies pay for the use of their special wires. Under normal circumstances the transit of the Pacific cable telegrams is effected only over Canadian territory. The Atlantic Cable Companies at present charge 1s. for the transmission in the service instructions of the date of a telegram and time of handing in, that is, one-fifteenth of the cost of a five-word telegram. All unrouted telegrams from this country to Australia handed in at postal telegraph offices are divided between the Anglo-American and Direct United States Cable Companies and the Commercial Cable Co.

**The Proposed Cocos Island to Ceylon Cable.**—It may be remembered that one of the recommendations of the Inter-Departmental Committee on Cable Communications, the report of which was issued in February, 1902, was that a cable should be constructed "connecting either Rodriguez and Ceylon, Cocos-Keeling or Ceylon, or Cocos-Keeling and Singapore." On the 16th, in reply to a question asked by Sir Edward Sassoon, as to whether he was now in a position to announce the conclusion of the arrangements for the laying of the Spur cable connecting Ceylon with the Cocos Islands, the Secretary of State for India replied in the negative.

### Telegraphic Interruptions and Repairs:—

| Cables. | Interrupted. | Repaired. |
|---|---|---|
| Latakia-Cyprus .. .. .. .. .. | June 20, 1899 .. | .. |
| Trinidad-Demerara No. 1 .. .. .. .. | Aug. 27, 1901 .. | .. |
| Dominica-Martinique .. .. .. .. .. | May 8, 1902 .. | .. |
| St. Lucia-Martinique .. .. .. .. .. | May 8, 1902 .. | .. |
| Guadeloupe-Martinique .. .. .. .. | May 9, 1902 .. | .. |
| Martinique-Puerto Plata .. .. .. .. | July 10, 1902 .. | .. |
| Cayenne-Pinheiro .. .. .. .. .. | Aug. 13, 1902 .. | .. |
| St. Lucia-St. Vincent .. .. .. .. .. | Sept. 19, 1902 .. | .. |
| Reissa-Issa .. .. .. .. .. .. | Oct. 23, 1902 .. | .. |
| Reissa-Yemani .. .. .. .. .. .. | Oct. 22, 1902 .. | .. |
| Paramaribo-Cayenne .. .. .. .. .. | Feb. 27, 1903 .. | .. |
| New York-Haiti .. .. .. .. .. | April 13, 1903 .. | .. |
| Siteebondo-Bandjermasin .. .. .. .. | July 6. 1903 .. | .. |
| Zanzibar-Mombassa .. .. .. .. .. | July 16, 1903 .. | .. |
| Perim-Assab .. .. .. .. .. .. | July 27, 1903 .. | .. |
| Fao-Bushire .. .. .. .. .. .. | July 28, 1903 .. | .. |
| Landlines. | | |
| U.S. of Colombia:—Landlines to Dagua .. | .. July 14, 1903 .. | .. |
| To Puerto Barrios .. .. .. .. | .. July 28, 1903 .. | .. |

**Wireless Telegraphy.**—In reply to a House of Commons question, Mr. Arnold-Forster stated that all battleships and a very large number of cruisers are fitted either with the Marconi system of wireless telegraphy or with modifications of that system. The present average expenditure upon wireless telegraphy is about £20,000 per annum, a considerable portion of this amount being paid to the Marconi Co. An agreement with the Marconi Co. is now being concluded, and the use of wireless telegraphy throughout the service will be greatly extended in the future.

The Prime Minister stated the other day that the question of the most desirable places for the establishment of wireless telegraphy stations is one which is constantly under the consideration of the Government Departments, and the eastern portions of the Empire are not omitted from their survey.

Rear-Admiral Grillo, Captain Bonomo (representing the Italian Ministry of Marine), Signor Cardarelli (Departmental Chief in the Ministry of Posts), and Lieut. Solari (on behalf of the Ministry of Posts), are to represent Italy at the International Conference of Wireless Telegraphy, which opens at Berlin on August 4th. Col. Rippisley will represent the British War Office at the Conference; the Admiralty will be represented by Captain H. L. Heath, R.N., Assistant Director of Naval Intelligence, accompanied by Lieut. C. R. Payne, who assisted Capt. Jackson, F.R.S., in many of his original and important experiments in wireless telegraphy, and is at present charged with the wireless telegraph duties on H.M.S. *Vernon*.

## CONTRACTS OPEN AND CLOSED.

### OPEN.

**Belgium.**—August 6th. Tenders are being invited by the Provincial Government authorities at Liège for the work of converting the tramway between Liège and Jerneppe to electric traction. Tenders are to be sent to Le Gouvernement Provincial, Liège, whence particulars may be obtained.

**Brighton.**—August 10th. Electricity meters for one year. See "Official Notices" July 24th.

**Edinburgh.**—August 3rd. Arc lamp-posts. See "Official Notices" July 24th.

**France.**—August 11th. The French Ministry of the Colonies, in Paris, is inviting tenders for the supply of 60 tons of annealed and galvanised iron wire required in connection with the telegraph service in Indo-China. Particulars may be obtained from, and tenders are to be sent to, Le Ministère des Colonies, Rue Jean Nicot 4 bis, Paris.

**France.**—August 13th. Tenders are being invited by the French Post and Telegraph authorities in Paris for the supply of 170,000 porcelain insulators. Tenders are to be sent to Le Sous-Secretariat d'Etat des Postes et des Telegraphes, Rue de Grenelle 103, Paris, whence particulars may be obtained.

**Guadeloupe.**—August 29th. Tenders are being invited until August 29th next by the municipal authorities of Point à Pitre (Guadeloupe) for the concession for the public and private electric lighting of the town.

**Halifax.**—August 4th. Feeder cables for electricity supply. See "Official Notices" to-day.

**Holland.**—October 1st. Tenders are being invited by the municipal authorities of Utrecht for the construction and equipment of a central electricity station for lighting and power purposes, and for the working of a tramway.

**Hungary.**—August 31st. Tenders are being invited until August 31st next by the municipal authorities of Besztercebanya (Neusohl) for the establishment in the town of a central electricity generating station of a capacity of 500 H.P.

**Launceston (Tasmania).**—September 28th. 500 or more electric meters. See "Official Notices" June 12th.

**Leeds.**—August 7th. Messrs. Graham, Morton & Co., Ltd., want tenders for the necessary electric cables, fittings, &c., for their new works. See "Official Notices" July 17th.

**London.**—August 11th. Low tension feeder switchboards for the tramways sub-stations in Camberwell and New Cross. See "Official Notices" July 10th.

**London.**—October 6th. Four 5,000-H.P. vertical-horizontal steam engines, each suitable for driving a three-phase generator, for the Greenwich power station. See "Official Notices" July 24th.

**New South Wales.**—September 12th. Tenders are being invited by the Railway Commissioners for New South Wales, for an additional generating set of 1,500 KW. for their tramway power station.

**Northampton.**—August 15th. Steam dynamos, battery, switchboard, equipment of trolley lines, feeders, cars, permanent way, buildings, car-sheds, piping, condenser, &c., for tramways power station. See "Official Notices" to-day.

**Portugal.**—October 21st. Tenders are being invited until October 21st by the Portuguese Ministry of the Colonies in Lisbon for the concession for the electric lighting of the town of Macao in the Portuguese Colonies.

**Rochdale.**—August 10th. Sixteen double-deck double-truck, 20 double-deck single, and 5 single-deck combination cars. See "Official Notices" July 24th.

**Stockport.**—August 4th. Tools, &c., for car-shed, workshops. See "Official Notices" July 24th.

**Stockport.**—August 4th. A 10-B.H.P. electric enclosed motor for the Corporation.

**Swindon.**—August 26th. Rails, permanent way, and paving for Corporation tramways. See "Official Notices" to-day.

**West Ham.**—August 21st. Traction switchboard, &c. See "Official Notices" to-day.

### CLOSED.

**Beckenham.**—The U.D.C. has accepted the tender, at £492, of the British Westinghouse Electric & Manufacturing Co., for electric meters.

**Coventry.**—The T.C. has accepted the tender of the Alphons Custodis Co. for the erection of the chimney-stack at the electric lighting works at £1,543, and that of Messrs. Kelley & Son for the remainder of the extensions at £1,772.

**Hammersmith.**—The Lighting Committee has received the following tenders for supplying the pumping plant required in connection with the extension of the condensing scheme:—Witting, Eborall & Co., Ltd. (recommended), £1,000; Crompton and Co, Ltd, £2,543; John Spencer & Co., Ltd., £2,662; the Lahmeyer Electrical Co., Ltd., £2,713. The following tenders were received for supplying arc lamps and accessories:—Enclosed type lamp, parallel system, Reason Manufacturing Co. (recommended), £373; General Electric Co., £377 5s.; Drake & Gorham, £407; Westminster Engineering Co., £447. There were 19 tenders for other types.

**Ipswich.**—The Corporation has placed an order with the British Westinghouse Co., for a watering and track-cleaning car, complete with all necessary electrical equipments, to be used in connection with the electric tramway system.

**Leicester.**—The Tramways Committee has accepted the following tenders:—Messrs. Dick, Kerr & Co., Ltd., for 58 cars at £570 each; Messrs. T. Hutchinson & Sons (Leicester), for the erection of the main car depôt at £16,846; Messrs. Maw & Co., Ltd. (Jackfield), wall tiling in engine room, £1,029; Messrs. Cross and Cross (Walsall), steel roofs for the main car depôt, £1,621 4s.; Messrs. Diespeker, Ltd. (London), floor tiling at the generating station; Messrs. Jones & Willis (Birmingham), railings and columns for the switchboard gallery at the generating station, £191 15s.; Messrs. Ashwell & Nesbit (Leicester), for heating the main car depôt, £318.

**London.**—The London County Council received the following tenders for the construction of a pier, river wall and condensing-water pipes at the Greenwich power station:—

| | |
|---|---|
| A. Fasey & Son (incomplete | £52,939 |
| J. Cochrane & Sons (accepted) | 55,558 |
| J. B. Squire & Co. | 57,340 |
| Pethick Bros. | 63,165 |
| Alfred Thorne | 64,341 |
| Sir Hiram Maxim Electrical Co. | 65,100 |
| T. Pedrette & Co. | 89,355 |

Steel Work for the Greenwich Station.

| | |
|---|---|
| J. Westwood & Co. | £36,808 |
| Dorman, Long & Co. | 39,831 |
| The Horseley Co. | 41,517 |
| Fulham Steel Works Co. | 45,297 |
| " " " (alternative, but not to specification) | 87,000 |

The Highways Committee recommended the Council to accept the tender of Messrs. Dorman, Long & Co. After discussion, however, at a meeting of the Council on Tuesday, it was decided to accept the tender of Westwood & Co., subject to the Chairman of the Committee approving the terms and conditions of the contract, but that otherwise the offer of Dorman, Long & Co., should be accepted.

Lighting and Bellwork at Rotherhithe Fire Station.

| | |
|---|---|
| Oliver, Clark & Co. (accepted) | £211 |
| F. J. Coleby & Co. | 220 |
| A. H. Marshall | 220 |
| L. Sunderland & Co. | 221 |
| F. A. Glover & Co. | 241 |
| Alliance Electrical Co. | 233 |

**Stepney.**—The B.C. Lighting Committee received the following tenders for feed, suction, and other pipework, storage tank, and water-softening plant:—Babcock & Wilcox, Ltd. (recommended), £1,612; Royles, Ltd., £1,612; Bertrams, Ltd., £1,684; Edward Le Bas & Co., £1,791; Fraser & Fraser, Ltd., £1,860; Sir Hiram Maxim Electrical Engineering Co, Ltd., £2,008; Thos. Waite, £2,025.

## ADDENDA TO ELECTRICITY WORKS AND TRAMWAYS LISTS.

Wolverhampton.—Generating plant: 3 Belliss, 2 Willans, 1 Peache engines; 3 E.C.C., 3 Parker dynamos; total capacity, 2,080 kw.; max. load, 1,190 kw. Pr. ltg., 43,606 8-c.p.; lamps added during year, 6,916. Pb. ltg., 53 arc, 20 inc. Motors, 432 h.p. Units sold: ltg., 1,012,399; tr., 612,240; total, 1,624,639.

Swansea.—Add 2 McLaren-British Westinghouse sets. Total capacity, 1,725 kw.; max. load, 547 kw. Total capital expd., £89,595. Pr. ltg., 45,000 8-c.p. Lamps added, 23,000. Pb ltg., 54 arc. Motors, 440 h.p. Price chgd. for pr., 2d. and 1½d. Units sold, 578,182. Av. price obtd., 3·54d. Works costs, 1·08d.; total costs, 1·48d.

Glasgow.—21 B. & W. boilers, no marine. Deduct 3 Willans-Siemens sets; add 3 Mavor & Coulson motor-generators recg. power fr. tramways dept. Total capacity, 12,396 kw.; max. load, 9,371 kw. Total capital expd., £1,080,124. Pr. ltg. (Mar. 31st, 1903), 619,363 8-c.p.; lamps added, 135,655. Pb. ltg., 719 arc = 11,345 8-c.p. Motors, 1,059 = 3,732 kw. Price chgd. for pr., 1½d. to 1d. Units sold during year, 11,501,324. Av. pr. obtd., 2·65d.; pr. ltg. only, 2·74d. Works costs, ·57d.; total costs, 2·01d. (excluding cost of change-over to 250 v.). Four geng. stations; small plant being replaced by larger sets.

Burton-on-Trent.—Tramways owned by Corpn.; opened 1903. Manager and engineer, P. J. Pringle. Miles of track, 7½; gauge, 3 ft. 6 in. Rails, 90 lb. Side bracket suspension. Motor-cars, 20. Motors, two 25-h.p. Dick, Kerr per car. Boilers, 6 Lanc.; generators, 3 Willans-B.T.H., total 300 kw. (exclusive of ltg. plant). Mains, B I.W. solid in earthenware troughs.

Peterborough.—Tramways owned by Peterborough Elec. Traction Co., Ltd.; opened 1903. Manager, F. P. Comber. Electl. engineer, B. Croft. Miles of track, 5·2; gauge, 3 ft. 6 in. Rails, 94 lb. Span wire and bracket arm suspension. Motor-cars, 12. Motors, Brush 800 B. Mains, lead-covd. and ppr.-insd., drawn into c.i. ducts.

Sutton and Howth Tramroad.—General manager, H. Plews; electrical engineer, A. W. Whieldon (G.N. Ry. I.). Motor-cars, 11. Motors, 37½ h.p. Westinghouse; 40 h.p., B.T.H. Plant capacity, 550 kw. Annual car-mileage, 80,000. Delete "W. H. Mills, Ch. Eng."

## NOTES.

**The Diesel Engine.**—The paper by Mr. H. A. de Clark upon this engine, which was read at the July meeting of the Institution of Mechanical Engineers, is distinctly a professor's paper. It deals with the history of the Diesel engine, and gives an outline of the inventor's line of thought. The result of reading this description is to impress upon the reader the fact that the inventor set out to do certain things which, while fitting in with thermo-dynamic theories, could not be carried out in practice. Thus Herr Diesel wanted a double or rather a compound curve of compression, a part of it being adiabatic, and a part being isothermal. He wanted a cylinder without a water jacket, but he had to come to the water jacket after all, because of the properties of materials of construction. The water jacket, of course, prevented any kind of theoretical compression curve, and the final compression curve is one with an index less than 1·4. One thing Herr Diesel did accomplish, and it was a good thing well done. He abolished all risk of premature explosion, simply by not compressing the fuel in the hot cylinder. He compressed pure air to the ignition temperature of the fuel, and he injected the fuel into the hot air. By thus eliminating all risk of premature explosion, Diesel rendered it possible to use very high compression, and this is practically all that he evolved from a supposed more theoretical system of working. The Diesel engine is really very little modified from the ordinary internal combustion engine, and the modification might just as well have been made, as it probably would soon have been made, by a mere mechanic. The compression of air alone was, however, an idea of great value, because it eliminates the dangers inseparable from all internal combustion engines, and more particularly from the use of the more easily exploded fuels, such as contain much hydrogen. The process of dilution of the Diesel idea is a little humorous to read, because water jackets had been found imperative by long experience, at lower temperatures than Diesel attempted. The only fault cured by Diesel was, in fact, that of insufficient compression, a fault long recognised by gas engine men, and every credit must be given to him for cutting out this obstacle to further development. The remainder of the paper deals with tests made on Diesel engines, which show an oil consumption as low as 0·476 lb. per B.H.P.-hour. It is, of course, essential that an engine run at 500 lbs. pressure, and with air compressed to a red heat, should be very well made. As high as 28·3 per cent. thermal efficiency is claimed to have been shown on test.

**The Strength of Shell Boilers.**—It is curious to read of the failure at Trieste to satisfactorily build two large donkey boilers. This appears to have convinced the authorities there that marine boilers cannot yet be constructed at Trieste, and they are built in England, sent out in pieces, and rivetted up at Trieste. Evidently, therefore, the difficulty they experience is not with the rivetting, but with the plating-up work. Some boiler makers may be very lax in the plating-up of their work. If two rings of plate fit loosely together, unless great care be taken to put in the first few rivets diametrically opposite each other, so as at once to divide the ring seams into a number of equal arcs, the slack fitting will all be driven together. By the above method any slackness of fit is equally divided round the ring seam, and better work results. An ideal perfection of plating work would be that which would enable a ring seam to be rivetted round, rivet by rivet, without any slackness accumulating. Modern plating of the best order comes very close to this perfection, but in all cases the course of the rivetting should be as explained above. The final perfection of work thus secured is such that large boilers are so nearly tight from the rivetters that caulking is little more than a formality. As shell boilers are now made, the longitudinal seams have a strength considerably over 80 per cent. of the solid plate. These seams, being always placed in the steam space, are not exposed to corrosion, and the strength of the under-water parts of a boiler may be reduced 20 per cent. without really destroying the initial pressure rating of the boiler. In fact, shell boilers are really constructed with a margin of nearly 20 per cent. for wear and tear—a margin that is very apt to be overlooked by those who speak about the inevitable reduction of pressure enforced by boiler insurance companies. Every boiler expert knows of this margin of strength initially provided, and knows that the weakest part of the shell is placed out of the range of corrosive influences. He further knows what a shocking appearance is presented by the interior of a badly corroded boiler, which has lost, perhaps, only 5 per cent. of its solid plate strength. Thick-and-thin advocates of water-tube boilers have, in fact, been so busy raising imaginary dangers for shell boilers that they have been too busy to attend to the deficiencies of their own pet schemes. Men who will travel over the Menai Bridge, which has stood 40 years' exposure to increasing loads and acid-laden atmosphere, tremble in presence of a shell boiler of modern high-class steel, with a margin of stress capacity perhaps double of the old punched plate-iron bridge.

**The Profit-Sharing Scheme of the United States Steel Corporation.**—The following details of this scheme, as described by Mr. Carnegie at the last meeting of the Iron and Steel Institute, may be of interest. During the year 1902 at least $2,000,000 of the earnings of the company, or as much more as might be necessary for the purchase of at least 25,000 preferred shares, were to be set aside. These shares were to be offered to the 168,000 employés of the corporation at the price of $82 50 per share, each man being allowed to subscribe for as much stock as he chooses up to a certain proportion of his salary. Men receiving $20,000 per annum or more are allowed to take up to 5 per cent.; those receiving between $10,000 and $20,000, up to 8 per cent.; between $5,000 and $10,000 up to 10 per cent.; between $2,500 and $5,000, up to 12 per cent.; between $800 and $2,500, up to 15 per cent.; and those receiving less than $800 per annum, up to 20 per cent. of the value of their wages or salaries. If more than 25,000 shares were applied for, 25,000 were to be allotted to the different classes, beginning with the lowest (last) first, each higher class receiving ratably according to the amount left for that class; but each applicant was to receive at least one full share even if it were necessary for the finance committee to purchase more than the 25,000 shares. The stock was to be paid for in monthly instalments deducted from the men's salary, such deduction not to exceed 25 per cent. of the total. Payments may extend over three years, dividends accruing to the subscriber from the date he begins to make payments, and interest at 5 per cent. being charged on deferred payments. Should a man discontinue payments before the stock has been fully paid for, he can withdraw the money paid on account of principal, and may keep the difference between the 5 per cent. paid as interest and the 7 per cent. received on the stock. When fully paid for, an ordinary certificate will be issued to the man, and he becomes free to sell the stock in the usual manner; but as an incentive to keep it, if he exhibits the certificate every January, together with the proof that he has remained in the employ of the corporation, and has shown proper interest in its welfare and progress, he will receive a special bonus of $5 per share per annum. The sums of $5 which the corporation does not have to pay owing to men leaving their employ will be set aside, and will be credited with 5 per cent. interest; and every fifth year this fund will be divided equally among the number of shares held by employés still in service, and will thus form a second bonus. If a man dies or becomes disabled during this five years, the money he has paid or the fully-paid share, together with a sum of $5 per share for each of the five years not expired, will be paid to him or to his estate. If the scheme is successful, a similar offer will be made at the close of the present year; but the stock will be offered at about the then market price.

**The Aniline Dye Trade.**—In the discussion which is now taking place about the alleged superiority of German methods of technical education, the coal-tar dye trade occupies a prominent position, because originally almost entirely British, it is at present almost entirely Continental. Two diametrically opposite explanations of this change of locality are offered, neither of which in its unqualified state is correct. On the one hand, the loss of the

industry in this country is ascribed to purely financial circumstances, and on the other its rise in Germany to a business of vast importance is attributed to the higher scientific attainments of the German chemists. The so-called aniline dyes are not made by electrical processes, and, therefore, we are not directly interested in the business; but the phenomena accompanying the transference of the industry across the sea are worth studying because they teach a lesson in the complexity of the causes which determine commercial success in technical directions. It is a fact that practically all the dyes first prepared from coal tar—only a few of which are derivatives of aniline—were discovered by English chemists, and were originally manufactured under their guidance in this country. Most of these dyes had serious defects: they were ugly in shade, fugitive, or difficult to use, and others were eagerly sought after. The German manufacturers first saw that a dye-making works is nothing but a chemical laboratory on a large scale; and in consequence they were far more willing than Englishmen to equip and finance experimental laboratories in which reasonably-paid research chemists were permitted and encouraged to discover new products. Thus it happened that very soon new and better dyes were found out in Germany, and were put on the markets at a time when our makers were still turning out the older materials. This kind of development has continued to the present day, and still remains greater in Germany than with us, not because the German chemists are individually better than their British compeers (they are not), but because an enormously larger number of chemists are engaged in German works. So far, the greater recognition of the money value of scientific ability has benefited the German dye-maker; but it by no means explains the decadence of the English industry. The second cause, which has been hardly less important, depends on the patent laws of the two countries. There is no difficulty for a German to obtain an English patent for a new process, but there is some when an Englishman applies for German protection. As the German chemists discovered new dyes, they immediately patented them here: not at all with the idea of making the substances in this country; and not at all with the object of extracting royalties from English manufacturers who might be desirous of working the processes, but simply with the intention of preventing the manufacture of the protected dyes anywhere except in their own factories. For the various reasons known to all experts in patent matters, it has not been possible for the English manufacturer to retaliate through the German patent system; and the net result is that the German can make at home, and export to us, nearly all the dyes that have been discovered in any country, while the Englishman can make only those materials which have not been patented, or which he has patented here before any foreigner. A third important cause depends on the state of feeling in Great Britain about physiological experiment. Although not dyes, many of the new drugs of the European pharmacopœias are coal-tar products, and they have been discovered in coal-tar laboratories. When such a material is met with here, the difficulties in the way of testing its physiological action, and its possible therapeutic value are so great—the physiologist is regarded as a sort of Spanish inquisitor or homicidal maniac—that hardly any man who values his peace of mind or is timid at the outcries of the faddists, will proceed with his work (unless he goes abroad); and the consequence is that nearly all of the newer remedial agents, antipyrine and a host of similar preparations, are German products—*de facto* even when not *de jure*. It is no secret to chemical manufacturers that a very large proportion of the profits made in German chemical works come from this department, *i.e.*, from the preparation of pharmaceutical products. These are the main technical reasons for the loss of the dye and "fine chemical" trades; there are others of a financial and political character. During the Franco-German war the English maker had a monopoly, virtually; but when peace was restored, his doom was sealed. Our railway and steamship companies with their remarkable notions about "dangerous" goods, and the way in which cost of carriage apparently sometimes varies in inverse proportion to the distance travelled, have helped the German; and, without entering upon the abstract question of Free Trade, the fact that he has enjoyed our Free-Trade system while we have suffered from his protection, has similarly assisted him. Probably, too, the greater energy and better commercial insight of the German Consular officials in foreign places have helped their countrymen more than our Trade Reports have helped us. All these causes, each according to its importance, have aided the German in seizing possession of the bulk of the tar dye trade, and of a large proportion of that in the more expensive chemicals; but nothing can be further from the truth than to assert that German development in these directions is due solely either to better finance or to the employment of more highly trained technical assistants. We might quibble and say that much of his success has been due to more highly-trained technical assistance; but this means simply that he has derived his inevitable benefit from maintaining large laboratories in which every chemist is not occupied all day long in supervising the workmen and the routine operations of the factory.

**The Works of Messrs. John Cockerill, Ltd.**—On July 17th the Association of the Birmingham Students of the Institution of Civil Engineers left England for a week's tour in Belgium. On Tuesday, 21st inst., the party went to Liège, and thence took boat for Seraing, where, under the guidance of Mr. Savage, they were taken through the works of the Cockerill Co. Founded by the son of an English emigrant nearly a century ago, this huge establishment now employs nearly 10,000 men. Our correspondent with the party writes:—"The first impression that one obtains, is that the company seem to manufacture almost everything on the engineering market—with the exception of electrical wares such as dynamos, &c. They are, however, fully alive to the advantages of electrically driving their plant, for in all the shops the cranes and the machine tools are thus operated. And, what was of even greater interest to the electrical engineers of the party, there were to be seen at work the large gas engines driving the dynamos for supplying power and lighting to the works. It must be confessed that this seemed to be done in rather a disjointed and scattered manner, for instead of the whole plant being in one main central station, it seemed to be in three or four parts of the works. However, there was the patent fact that large gas engines, of 600 H.P. each, were running in parallel in a perfectly satisfactory manner. The speed was 125 r.p.m., and these engines were single-acting. They were running on blast furnace gas. There were to be seen, also, quite a number of these gas engines—some of them double-acting—at work driving blowing engines for the furnaces. This company was the first to introduce to the Continent that greatest invention of modern metallurgy—the Bessemer process, and a vast amount of power is used up in supplying the air blast to the converters. In the erecting shop there was a double-acting 1,200 H.P. gas engine, ready for its trials. The fly-wheel was 20 ft. in diameter. Our guide assured us that it would be quite possible to build an engine of 2,400 B H.P., *i.e.*, of two such double-acting tandem-cylinder engines coupled direct to the same shaft, the alternator being placed between them. And, said Mr. Savage, the alternators coupled under such conditions would run quite easily in parallel, the angular variation being less than is the case with many steam engines. It is not unusual for engineers in England to associate this company with the manufacture of gas engines only; but we saw completed in their workshops the marine engines of a Congo steamer, a locomotive for the Belgian State Railways, parts of a bridge for the Brussels canal—in short; almost everything connected with iron and steel work."

"The party also visited the University, Liège, and on Wednesday inspected the works of M. Bollinckx, at Brussels. Most of us also took the opportunity of visiting the field of Waterloo."

**Competition in South Africa.**—The correspondent of an American journal who is out in South Africa congratulates his countrymen on the advantages they possess in being able to ship goods to Cape Town more cheaply than can be done from England. This is due, he says, to the shipping combine, which extorts high rates and is doing so much apparently to damage the home trade. The rates from America are 10 per cent. less than English rates. The correspondent appears to be sound and trustworthy in what he says, and so far as negative competition is of any good, the British manufacturer who has been lectured and hectored a good deal of late may extract some comfort from the statements that Americans pack their goods in boxes much too large, often use a lot of straw-filling, and yet omit vaseline paper, and indeed, often appear to act up to the belief that as their goods are going so far, no more will be heard of them, which is probably very true, for nothing more is heard of them nor of any more orders. Some files arrived little better than rust, and the supposed virtues of American packing became very microscopic; one of the chief faults being the habit of missing out parts. We do not know whether this is more than ordinarily an American fault, but it is one that has attracted attention in this country also. There are, however, some American firms who pack goods very differently. True, the large box idea is apt to prevail to an unnecessary extent, but the system of packing has been perfect, everything being held in place by properly secured bits of timber, and no paper or straw being employed. Neither straw nor paper is a healthy article wherewith to pack goods of iron or steel. Both materials are inherently damp in our climate, and tend to produce rust. American engineers are very prone to send orders to America irrespective of quality, and the large number of mining engineers on the Rand, who are Americans, is a fact certainly not in favour of British productions. It is, we know, claimed that Americans are great on rock drills, but engineers who have used all types tell us that English-made rock drills are superior to any others, and if given a fair chance they would have as good a sale as any American drill. Such a body as the London Chamber of Commerce ought to inquire into the question of freights and the damaging effects of the shipping combine.

**Marriages.**—Mr. Henry Burstall, M.I.C.E. (of the firm of Burstall & Monkhouse, consulting electrical engineers, Westminster), is to be married to-morrow to Miss Alice Maud McLellan, youngest daughter of the Mayor of Rochester. The marriage will take place at the Cathedral Church of Rochester.

Yesterday (Thursday), Mr. Robert N. Tweedy, resident engineer of the Dudley, Stourbridge and District Electric Traction Co., Ltd., was married at St. Gabriel's, Willesden Green, to Miss Emilie Josephine Marsh, youngest daughter of the late Rev. Peter Marsh, of O'Meath, co. Louth and Ballinaminton, Moate, co. Westmeath, Ireland. The ceremony was performed by the Rev. G. Clibborn, vicar of St. Gabriel's, and cousin of the bride; assisted by the Rev. H. H. Tweedy, brother of the bridegroom. The bride was given away by Mr. J. A. P. Marsh, her brother, who is electrical engineer to the Dudley Corporation. We shall only be voicing the sentiments of the large number of electrical friends by whom he is known and appreciated, when we wish Mr. Tweedy and his wife long-continued health and happiness.

**Gas v. Electric Light in Schools, &c.**—The official returns recently made to the Bavarian Government on the subject of the best lighting for schools and similar institutions are summarised in two numbers of the *Journal für Gasbeleuchtung*; the reports show that from the hygienic standpoint petroleum lamps, and flat flame and Argand gas burners must be excluded, and the

comparison resolves itself into one between Welsbachs and electric incandescents. Welsbachs are said to give a better distribution of light with less heat radiation; but, of course, give off more heated gases. Direct lighting gives more powerful illumination than indirect or reflected, but the effect on the eyes and head is bad. The radiation of heat produces dryness in the eyes, a feeling of tension in the forehead, hot head and headache. Direct light causes congestion of the retina, and a demand for more and more light. When direct lighting is employed the electric incandescent is necessary, and the light should come from one side only, and should be screened.

Indirect lighting, although apparently rather a dim light, is one of great comfort. The loss of light is not so great as might be supposed. With six Welsbachs in a room having a floor area of 660 sq. ft., the illumination varied from 25·3 metre-candles to 9·7, the average being 17·5. With indirect the figures were 19·1, 13·3, and 16·2. The minimum illumination should be 10 metre-candles at any point, and for fine work 15 to 25. For drawing from models reflected lighting is not good, owing to insufficient shadow. Arc lamps and, of course, incandescents give less trouble than Welsbachs. For rooms more than 16 ft. 8 in. high electric light is to be preferred. One 10-ampere arc should be allowed for an area of 463 sq. ft.; two six-ampere lamps for 538 to 645 sq. ft.

**Electricity in Mines.**—From the reports of H.M. Inspectors of Mines recently issued, a marked increase has been made in the use of electrical coal-cutting machines, the following statement showing the number of machines in use during the years 1901 and 1902:—

| District. | 1901. | 1902. |
|---|---|---|
| East Scotland ... ... ... ... | 1 | 11 |
| West Scotland ... ... ... ... | 3 | 7 |
| Newcastle ... ... ... ... ... | Not stated. | 5 |
| Durham ... ... ... ... ... | 11 | 20 |
| York and Lincoln ... ... ... ... | 22 | 35 |
| Manchester and Ireland ... ... ... | 11 | 9 |
| Liverpool and North Wales ... ... | Not stated. | 4 |
| Midland (for 1900) ... ... ... ... | 28 | 44 |
| Stafford ... ... ... ... ... | 12 | 10 |

Mr. McLaren, H.M. Inspector for East Scotland, states:—'Machines driven by electrical power are on the increase"; and Mr. Hall, H.M. Inspector for Liverpool and North Wales, remarks:—"Electric haulage and lighting is becoming more general. There appears to be very great variety of opinion among experts as to the best kind of power cable for underground work; and also a wide difference of opinion as to the risks attending the use of electricity in collieries"; while Mr. Stokes, H.M. Inspector for the Midlands, says:—"The method of driving the coal-cutter by electricity appears to be not only the cheapest, but the easiest of application. To drive by compressed air means frequent attention to pipes, with the addition of considerable noise in the working face from the exhaust air, whereas electrical power may be carried with a single cable, and the installation may be used for lighting, pumping, hauling, and coal cutting, by means of a cable, which can be moved with ease, and without delay. If coal cutters are run with worm gear, working in oil, and driven by electricity, there should be little noise, beyond that due to the teeth of the cutter-wheel scratching out the holing cut, and men have a much better chance of hearing any subsidence, or breaking of the roof or timber, than when a noisy exhaust from compressed air renders it difficult to hear what is taking place." Considering that 53·8 per cent. of underground fatal accidents are due to "falls," the latter part of Mr. Stokes's remarks have an important bearing.

**The National Electrical Contractors and Manufacturers' Associations.**—After lengthy conference, the committees of these two Associations on Monday arrived at a basis of agreement. Owing to the many difficulties encountered, it has taken a long time to bring the negotiations to a successful issue. It is believed, however, that the basis of agreement come to will prove of a very satisfactory nature to members of both Associations. The various heads of the agreement were, later in the day, submitted to the central board of contractors and approved by them. The Manufacturers' Association also held a general meeting of its members, who approved of the steps taken by their committee on their behalf. Parties interested in the matter can obtain further particulars from the secretaries of the two Associations.

**Erratum.**—In our leading article last week, by a printer's error, we, unfortunately, were made to say that the charge for street lighting was 3·33d. per unit at Salford; the name of the town should have been Stafford. The price at Salford is only 1·29d., and has never exceeded 2·11d. We regret that the error took place.

**Institution of Mechanical Engineers.**—On Tuesday the annual conference was opened at Leeds Philosophical Hall. Nearly 500 members assembled. Mr. J. Hartley Wicksteed, of Leeds, the President of the Institution, presided. Mr. H. Ade Clark, of the Yorkshire College, contributed a paper on "The Diesel Engine," and a discussion followed, in which Mr. E. R. Dolby, Professor Goodman, and others took part.

**Lancaster Electricity Works.**—The Electricity Committee are offering certain old plant for sale. The engineer has been authorised to fix Meldrum forced draught to the two new Lancashire boilers at the electricity works, at a cost of £140.

**Appointments Vacant.** — Canvasser for Battersea Borough Council; junior assistant electrical engineer, for Hanley (£100); electrician and linesman for the Lagos Government Railway at £300. See "Official Notices" to-day.

**Bradford Electricity Department.**—The Tramways Committee on Tuesday further discussed the question of the proposed amalgamation of the tramways and electricity departments. It is contended by those who desire the amalgamation that such a step would tend to greater efficiency and economy, and it is thought that inasmuch as the position of electrical engineer is now vacant, the heads of the two departments might very well be combined. This idea, according to a Leeds paper, seemed to find general favour with the members, and it was agreed that the salary of the manager should be £700, rising annually to £1,000 in three years.

**Kaye's Oil Cans.**—We understand that since the notice of Kaye's new patent serrated oil cans appeared in our issue of July 5th, Messrs. Joseph Kaye & Sons, Ltd., of Leeds, have received an order from H.M. Navy for 7,500 of these oil cans.

**Works for Sale.**—As will be seen from a notice among our advertisements to-day, the works of the Grant's Drill and Trolley Co. (in liquidation) are offered for sale by private treaty.

**Personal.**—At Tuesday's meeting of the L.C.C., Mr. J. Burns, on the motion for the reception of the report of the Highways Committee, asked the chairman as to the accuracy of a statement made in a Birmingham newspaper that day, announcing that Mr Alfred Baker, the manager of the London County Council Tramways Department, had accepted an offer to go to Birmingham to manage the municipal tramways. In reply to this question, Mr. J. W. Benn stated that the best response would be to read a letter which he had received from Mr. Baker that morning. The letter stated that the writer had been offered, and he had accepted, the position of general manager of the Birmingham Corporation tramways, and that he had placed his resignation the hands of the chairman of the Council. Mr. Benn said that he had received the letter with regret, and he remarked that it was unfortunate that the Council should lose so able an officer. The resignation of the tramways manager having been accepted, the Council authorised the issue of advertisements for a successor.

Mr. J. Fierz has recently been appointed chief electrician to the Brush Co. He brings with him from the Continent a high reputation for technical ability. A Swiss by birth, Mr. Fierz received his early training at the Polytechnic High School of Zürich, where he took his diploma with honours as mechanical and electrical engineer. His first engagement was with Messrs. Brown, Boveri and Co., of Baden, Switzerland, with whom he was chiefly occupied with the design of polyphase alternators. Mr. Fierz afterwards spent some time with a French firm, which he left on being offered the position of designer for continuous-current machinery at the Charleroi works of the Société Electricité et Hydraulique. Subsequently and in succession to Mr. Heyland, one of the most eminent Continental designers, the supervision of the alternating current department was added to his duties, and a considerable number of single and polyphase generators, synchronous and asynchronous motors, &c., were developed during his stay. The result of Mr. Fierz's work at Loughborough will, no doubt, soon be practically appreciated in the British market for the latest types of generators, motors, and other electrical apparatus.

Prof. J. A. Ewing, F.R.S., LL.D., has been appointed a member of the Explosives Committee in the place of the late Sir W. C. Roberts Austen, K.C.B., F.R.S., D.C.L.

Mr. A. H. Sears and Mr. T. Welbeck Graves have been appointed by the London County Council as electrical assistants in the engineer's department in the second class at the commencing salary at £175 a year each.

## THE CENTRAL STATION ENGINEER.

Mr. Stainer Hutchins has resigned his position as assistant electrical engineer at the Hanley Electricity Works, to take up a post with the Industrial Engineering Co., Newton, Hyde, that firm having taken up his patent motor, speed gear and automatic clutch.

The staff and employés of the Ilford Electricity Works went for their annual outing on Saturday, July 18th. The company numbering 46, drove to Roydon, Herts. Mr. A. H. Shaw, the electrical engineer, presided at the dinner and tea, which were held at "New Inn." A walking stick was presented to Mr. W. G. Thomas, for services rendered as hon. secretary of the outing arrangements.

On Thursday last week a cricket match was played at Worcester between the staffs of the alternating and continuous current generating stations. The rivalry was very keen. The match was won by the "Alternators" by the narrow margin of three runs. C. Bayliss and A. Knott were the most successful batsmen. The match is in future to be an annual event, and a challenge cup has been presented by the chief engineer.

## NEW COMPANIES REGISTERED.

**Bath Electric Manufacturing Co., Ltd.** (78,083).—This company was registered on July 21st, with a capital of £15,000 in £1 shares, to adopt an agreement with H. V. Kramer and J. A. Steven, to acquire and turn to account certain inventions in relation to electric-motor controllers and resist-

ance material, and the patent rights for such inventions, and to carry on the business of electrical engineers, electricians, mechanical engineers, and manufacturers of and dealers in all apparatus, machinery, appliances and materials used in connection with the generation, distribution, supply, regulation, control, accumulation and employment of electricity. The first subscribers (each with 50 shares) are:—H. V. Kramer, c/o H. V. Kramer & Co., electric power engineers, Lower Weston, Bath, engineer; Mrs. B. R. von Kramer, 49, Newbridge Hill, Bath; J. A. Steven, Provanside, engine works, Glasgow, engineer; W. J. Hack, c/o H. V. Kramer & Co., Lower Weston, Bath, engineer; P. K. Stothert, Woolley Grange, Bradford-on-Avon, Wilts, M.I.C.E.; W. Pitt, c/o Stothert & Pitt, Bath, M.I.C.E.; and J. H. Brown, c/o H. V. Kramer & Co., Lower Weston, Bath, A.I.E.E. Minimum cash subscription half the shares offered to the public. The number of directors is not to be less than three nor more than five; the first are K. V. Kramer, J. A. Steven and W. Pitt; qualification, £50; remuneration, 5 per cent. of the net profits available for distribution.

**British Electric Separating Co., Ltd.** (78,130).—This company was registered on July 24th, with a capital of £6,000 in £1 shares, to acquire the business of tin strippers carried on at Swansea by H. A. Leaver, as "H. A. Leaver & Co.," and to carry on the business of stripping tin from tinplate scrap and other articles by electricity or otherwise, and any business connected with the electro-deposition of metals. The first subscribers are:—H. A. Leaver, Swansea, metal merchant, 100 shares; J. R. Leaver, Glannant, Westeron, Swansea, J.P., works manager, 100 shares; B. Dickinson, 59, Holbeach Road, Catford, S.E., gentleman, 100 shares; A. Sinziminex, 3, Priorton Terrace, Swansea, chemist, 1 share; A. B. Livingston, 7, Sketty Road, Swansea, coal exporter, 1 share; E. M. Jones, 12, Walter Road, Swansea, cashier; and T. H. Vaughan, 4, Richmond Road, Swansea, accountant, 1 share. Minimum cash subscription 20 per cent. of the shares offered to the public. The number of directors is not to be less than three nor more than five; the first are H. A. Leaver, J. R. Leaver and B. Dickinson; qualification, £100; remuneration as fixed by the company. Registered office, New Cut Road, Swansea.

**Electrical Engineering Co. of London, Ltd.** (78,086).—This company was registered on July 21st, with a capital of £1,000 in £1 shares, to construct and maintain cables, wires, lines, accumulators, lamps and works, to generate and supply electricity, and to carry on the general business of electricians, electrical and mechanical engineers, manufacturers of and dealers in electrical apparatus, suppliers of electric light, &c. The first subscribers (each with one share) are:—T. E. Brown, 90, Boston Road, Hanwell, W., engineer; C. Clarke, 44, Derrick Street, Rotherhithe, electrician; J. Amey, 301, Fore Street, Edmonton; A. E. Short, Kimberley Villas, Lower Edmonton, electrical engineer; W. A. Daniels, 81, Knightrider Street, E.C., restaurant proprietor; J. M. Baxter, 60, Watling Street, E.C., stationer; and J. G. Evans, 12, Sunnyside Road, Upper Holloway, N., builder. No initial public issue. Registered without articles of association.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Underground Electric Railway Co. of London, Ltd.** (73,376).—A trust deed dated May 29th, 1903, covering a series of profit-sharing secured notes for an aggregate nominal amount not exceeding £7,000,000, has been registered. Date of resolution creating series: April 30th, 1903. Property charged: various stocks and shares in railway and other companies, as scheduled in trust deed. Trustees: The London and Westminster Bank, Ltd., 41, Lothbury, E.C.

**Electric Reduction Co., Ltd.** (54,724).—Issue on June 25th of £2,000 debentures, part of a series created December 18th, 1899, to secure £15,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously outstanding of same series, £5,500.

**Newcastle-upon-Tyne Electric Supply Co., Ltd.** (27,997).—Issue on June 18th of £38,600 4 per cent. debentures (386 of £100 each), part of a series created October 3rd, 1901, to secure £250,000. Property charged: the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series, £211,400.

**Electric Traction Co. of Hong Kong, Ltd.** (75,486).—A trust deed dated July 1st, 1903, to secure £195,000 debentures created by resolution of December 17th, 1902 (none of which have yet been issued) has been registered. Property charged:—(Specifically): £300 fully-paid shares in the Hong Kong Tramway Co., Ltd. (As a first and floating security): all the company's assets, present and future, including uncalled capital. Trustees: United Exploration Co., Ltd., 19, St. Swithin's Lane, E.C.

**Melton Mowbray Electric Light Co., Ltd.** (53,018).—This company's annual return was filed on March 24th, when 1,610 shares had been taken up out of a nominal capital of £10,000 in 2,000 shares of £5 each. £5 per share has been called up, and £8,050 has been paid. Mortgages and charges: £10,000 (£5,000 further debentures subsequently issued).

**Melton Mowbray Electric Light Co., Ltd.** (53,078).—Issue on June 23rd of £5,000 debentures, part of a series created March 6th, 1901, to secure £20,000, charged on freehold land in Regent's Street, Melton Mowbray, and the company's buildings, machinery, plant and other property, present and future, including uncalled capital. Trustees under deed of April 17th, 1901: W. B. Hopkins, Clun House, Surrey Street, W.C., and F. E. Gripper, Broad Sanctuary Chambers, S.W. Previously issued of same series: £10,000.

**Sherard Cowper-Coles Co., Ltd.** (67,136).—Issue on July 7th of £600 debentures, part of a series created by resolutions of December 3rd, 1901, and February 7th, 1902, to secure £6,500, charged on the company's property, present and future, except uncalled capital. No trustees. Previously issued of same series: £5,350.

**Peterborough Electric Traction Co., Ltd.** (74,562).—This company's annual return, made up to October 31st, 1902, was filed on April 21st, 1903. The capital is £60,000 in 6,000 ordinary and 6,000 preference shares of £5 each, of which seven shares have been taken up and paid for in full. No mortgages or charges. [Subsequently to date of above return, 4,000 ordinary and 4,000 preference shares have been allotted.]

**Royce, Ltd., Electricians, Manchester** (63,871).—Issue on July 10th of £5,000 debentures, part of a series created March 27th, 1903, to secure £25,000, charged on the company's undertaking and property, present and future, except uncalled capital. Trustees under deed of March 25th, 1903: The Law Guarantee and Trust Society, Ltd., 49, Chancery Lane, W.C. Previously issued of same series: £12,100.

**Ingleton Electric Lighting and Power Co., Ltd.** (60,796).—Issue on July 14th of a debenture for £100, part of a series created August 8th, 1902, to secure £450, charged on the company's undertaking and property, present and future, including uncalled capital, subject to prior debentures amounting in all to £2,200. No trustees. Previously issued of same series, £300

**Woking Electric Supply Co., Ltd.** (46,175).—Issue on June 20th of £100 debentures, part of a series created November 2nd, 1899, to secure £25,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £22,200.

**West African Telegraph Co., Ltd.** (21,626).—This company's annual return was filed on July 3rd, when 23,109 shares had been taken up out of a nominal capital of £400,000 in 40,000 shares of £10 each. £10 per share has been called up, resulting in the receipt of £231,090. Mortgages and charges, *nil*.

**National Electric Wiring Co., Ltd.** (53,364).—This company's annual return was filed on June 16th, when 118,971 shares had been taken up out of a nominal capital of £250,000 in £1 shares. £1 has been called up on each of 100,120 shares, resulting in the receipt of £100,120. 18,851 shares are considered as fully paid. Mortgages and charges, *nil*.

## SUPPLY STATION ACCOUNTS.

**Croydon Corporation Electricity Department.**

The past year's returns for the Borough of Croydon electrical department show a continuation of the rapid expansion in business which formed a special feature of the previous year. This has been largely due to the acquisition of a traction load, which during the past 12 months contributed some 967,924 units out of the increase of 1,321,454 units, or 73 per cent.

Since the advent of Mr. J. Gray Scott to the position of electrical engineer many improvements in detail in the generating plant and a change-over in the central part of the town from alternating to direct supply have been carried out, all of which should tend to increase efficiency in working. He has also a further large extension scheme in view, necessitated by the rapidly growing demands of the area. The total capacity of the plant in kilowatts amounts to 3,215.

GENERAL STATEMENT.

| For year ending March 25th— | | 1902. | 1903. | Inc. |
|---|---|---|---|---|
| Total capital expended ... | ... | £212,389 | £231,343 | £18,954 |
| Units sold private lighting ... | ... | 986,372 | 1,189,943 | 203,571 |
| " " public lighting ... | ... | 480,962 | 630 921 | 149,959 |
| " " traction ... ... | ... | 343,053 | 1,310,977 | 967,924 |
| Total number of units sold... | ... | 1,810,387 | 3,131,841 | 1,321,454 |
| Number of 30-watt lamps connected | | 78,386 | 96,479 | 18,093 |
| Number of public lamps ... | | 386 arcs. | 392 arcs. | 6 arcs. |
| | | 24 incan. | 26 incan. | 2 incan. |
| Maximum load in kilowatts | ... | 1,683 | 2,127 | 444 |
| Revenue Account. Gross revenue | ... | £27,483 | £40,157 | £12,674 |
| " expenditure | ... | £14,582 | £21,889 | £7,307 |
| " profit ... | ... | £12,901 | £18,268 | £5,367 |
| Average price per unit sold | ... | 3·56d. | 3·03d. | — ·53d. |

The increase in revenue from all sources during the year amounts to £12,674, as compared with a similar increase of £9,300 last year.

The prices charged are as follows:—Private lighting, 7d. and 2d. maximum demand, or 5d. flat rate, per unit; power, 2½d. per unit; traction, 2d. per unit; and for public lighting, £18 per arc per annum.

REVENUE STATEMENT.

| | 1902. | | 1903. | | |
|---|---|---|---|---|---|
| | Gross. | Per unit. | Gross. | Per unit. | Inc. |
| Sale of energy ... ... | £26,780 | 3·56d. | £39,512 | 3·03d. | —·53d. |
| Meter rents ... ... | 615 | ·08d. | 411 | ·03d. | —·05d. |
| Sundry receipts ... | 88 | ·00d. | 234 | ·02d. | ·02d. |
| Gross revenue ... | £27,483 | 3·64d. | £40,157 | 3·08d. | —·56d. |

The works costs again show a satisfactory decrease of ½d. per unit sold. While the item for fuel still improves, in spite of the high initial cost of coal, the great reduction appears in management expenses, which are ·14d. down. The total works costs are now 1·68d. per unit—an improvement on many of the more modern systems in the neighbourhood of the metropolis.

WORKS COSTS.

| | 1902. | | 1903. | | |
|---|---|---|---|---|---|
| | Gross. | Per unit. | Gross. | Per unit. | Inc. |
| Coal .. .. .. .. .. .. | £6,954 | ·92d. | £10,758 | ·83d. | —·09d. |
| Oil, waste, water and engine-room stores .. .. .. .. .. | 860 | ·11d. | 1,232 | ·09d. | —·02d. |
| Salaries and wages incurred in generation and distribution, and attending public lamps .. .. | 1,372 | ·19d. | 3,513 | ·27d. | ·08d. |
| Repairs and maintenance of buildings, engines, boilers, dynamos, &c., and public lamps .. .. | 1,818 | ·24d. | 2,320 | ·18d. | —·06d. |
| Works and distribution costs | £11,024 | 1·46d. | £17,823 | 1·37d. | —·09d. |
| Rent, rates and taxes .. .. | 416 | ·06d. | 1,092 | ·08d. | ·02d. |
| Management expenses, salaries engineer, secretary, and clerical staff .. .. .. .. | 1,968 | ·26d. | 1,520 | ·12d. | —·14d. |
| General establishment charges, stationery, printing, insurance, &c. .. .. .. .. .. | 1,178 | ·15d. | 1,454 | ·11d. | —·04d. |
| Total expenditure .. | £14,582 | 1·93d. | £21,889 | 1·68d. | —·25d. |

Financially, the department has had a very successful year, some £18,000 gross profit having resulted, as compared with £13,000 in 1902.

Interest and sinking fund absorbed £13,545, leaving a net profit on the year's working of £4,655; of this sum £3,000 was transferred to the reserve fund, and £1,000 to the rates.

PROFIT STATEMENT.

| | 1902. | 1903. |
|---|---|---|
| Interest on loans ... ... ... ... | £5,707 | £6,840 |
| Sinking fund ... ... ... ... | 4,622 | 6,705 |
| Balance carried to next account ... ... | 51 | 68 |
| Net profit for year ... ... ... ... | 2,521 | 4,655 |
| Gross profit ... ... ... | £12,901 | £18,268 |

# CITY NOTES.

## British Thomson-Houston Co., Ltd.

MR. W. A. MCARTHUR, M.P. (Chairman), presided at 83, Cannon Street, E.C., on Wednesday, over the eighth ordinary general meeting of the above company, when the following report was presented:—"The directors have pleasure in submitting their seventh annual report and statement of accounts, covering the period of nine months from July 1st, 1902, to March 31st, 1903. The additional building for stores and manufacturing purposes mentioned in the sixth annual report has been completed, and adds greatly to the capacity of the works. The number of hands employed is steadily increasing; the staff, exclusive of those employed in the office, now numbers nearly 1,300—more than double the number employed at the time of the last report. During the period under review further important additions to the factory buildings have been authorised and are now under construction, which will largely increase our manufacturing facilities. A large extension to the office building has been necessitated by the increase in the business of the company, and contracts for its construction will be let in the near future.

"*Great Northern and City Railway.*—The company has completed the electrical work in connection with this installation and the trials of the electrical trains have proved satisfactory.

"*Hamilton, Motherwell and Wishaw Tramways.*—The contract in connection with this enterprise is approaching completion and the road will be opened for traffic this summer.

"*North-Eastern Railway.*—During the period under review the company has secured the contract for the electrification of the local lines of this railway in the Newcastle district, and the work is now actively progressing.

"*Central London Railway.*—We have furnished multiple unit train control equipments to replace the locomotives on this railway, and these trains are running with satisfactory results.

"*Lancashire Power Construction Co., and Yorkshire Electrical Power Co.*—The company has secured contracts for the complete steam and electrical installation for these two large power schemes.

"*Curtis Turbine.*—The company has recently acquired exclusive rights to sell the Curtis steam turbine for electrical purposes in the United Kingdom. Contracts have already been secured for turbo-units of an aggregate capacity of 11,000 KW. A 500-KW. Curtis turbine will be added to the plant of the company at its Rugby works, and will be available for inspection during the autumn.

"*Other Enterprises.*—Your directors believe that the company has good value in the other enterprises in which it has investments, and are satisfied with their condition and prospects.

"The profits after deducting general and technical expenses, discounts and interest, amount to £47,064 15s. 7d., of which sum £21,466 15s. 8d. has been applied as shown in the profit and loss account. The available balance (as shown by the balance-sheet) is £21,271 17s. 6d., which the directors recommend be distributed as follows:—

| | | | |
|---|---|---|---|
| £2,447 | 9 | 7 | to dividend accrued March 31st, 1903, on £400,000 4 per cent. cumulative preference shares, fully paid. |
| 12,000 | 0 | 0 | to dividend at the rate of 4 per cent. per annum for nine months on £400,000 ordinary shares, fully paid. |
| 2,353 | 4 | 9 | to reserve, being 5 per cent. on £47,064 15s. 7d. |
| 4,471 | 3 | 2 | to profit and loss new account. |
| £21,271 | 17 | 6." | |

The CHAIRMAN formally moved:—"That the report of the directors produced, together with the annexed statement of the company's accounts at March 31st, 1903, duly audited, be now received, approved and adopted, and that the recommendations therein contained as to dividends and otherwise be adopted and carried out."

Mr. FRANKLIN seconded the motion, and it was agreed to.

Mr. MONKS moved the re-election of the retiring directors, Messrs. W. A. McArthur, C. Burrell, E. W. Rice, and General E. Griffin.

Mr. LAZARUS seconded the motion, and it was carried.

The re-election of the auditors, Messrs. Price, Waterhouse & Co., proposed by Mr. F. W. LAZARUS was agreed to, and the meeting ended.

## Eastern Telegraph Co.

THE report for the half-year ended March 31st last, presented to the meeting on 29th inst., states that revenue for the period amounted to £626,000, from which are deducted £162,847 for the ordinary expenses and £27,472 for expenditure relating to repairs and renewals of cables, &c., during the half-year. After providing £7,207 for depreciation of spare cable, £110 for sundry differences in exchange, and £11,365 for income-tax, there remains a balance of £417,748, to which is added £22,383 brought from the preceding half-year, making a total available balance of £440,131. From this there has been paid interest on mortgage debenture stock, dividends on preference stock, and an interim dividend of 1¼ per cent. on the ordinary stock, leaving a balance of £320,031, out of which the directors have placed £5,000 to reserve fund for maintenance ships, and £180,000 to general reserve. They now recommend a final dividend on the ordinary stock for the year of 1¼ per cent., and a bonus of 2 per cent., amounting together to £130,000, making, with the three previous payments on account, a total distribution of 7 per cent. for the year. The balance of £5,031 is proposed to be carried forward.

The sixty-second half-yearly meeting of the shareholders of the company was held on Wednesday at River Plate House, E.C., Sir J. Wolfe Barry, K.C.B., in the chair.

The CHAIRMAN, in proposing the adoption of the report, said the gross revenue for the half-year ending March 31st, 1903, amounted to, in round figures, £626,000, as against, in the corresponding period of 1902, £617,000, or an increase of £9,000. Of this increase about £4,000 was derived from the message receipts, about £1,000 more had been received from investments in other telegraph companies, and over £4,000 of the excess had been received from interest on their surplus funds placed on loan and deposit. As compared with the corresponding period of 1902, the following reduced tariffs had been in operation during the whole of the present half-year:—(1) Between Europe and the Straits Settlements and the Dutch Indies, from 4s. 6d. to 3s. 6d. and from 5s. to 4s. respectively, and for Sumatra and other islands from 5s. 5d. to 4s. 5d. (2) Between Great Britain and Victoria, 4s. 10d. to 3s.; Queensland, 5s. 1d. to 3s.; and New Zealand, from 5s. 2d. to 3s. 4d. under agreements for "Standard Revenue" with certain of the Australian Colonies, which have since been completed by a tentative agreement with the Federal Government of Australia, which only awaited ratification by the Senate. (3) During the whole of the present half-year, as against one month in the corresponding period of 1902, the traffic between Europe and India was carried at the reduced rate of 2s. 6d. per word against 4s. previously charged, under a basis of partial guarantee and "Standard Revenue" agreed with the Indian Government. (4) For three months—viz., from January 1st last—the rate for messages from Great Britain and Europe to South and East Africa and Mauritius was reduced from 3s. to 2s. 6d. per word, under an agreement for "Standard Revenue" made with the British and Colonial Governments. Notwithstanding those important reductions in the tariffs and the competition of the British Pacific Cable, to which they had up to the date of the accounts been exposed for about four months, he thought they had cause to congratulate themselves on the gross increase in the revenue, however small. Although the traffic receipts were actually larger than they were 12 months ago, even after the introduction of so many important reductions in the tariff rates, and the adverse circumstance to which he had alluded, it should be clearly understood that the increase in the receipts is not due to the reductions in the rates, in fact, the effect of those reductions in themselves was at present at least, in the opposite direction, for, with the exception of the Cape Joint-Purse traffic, there was a considerable reduction in the amount received during the half-year from those places which had benefited by the reduced rates to which he had just alluded. They trusted, however, that at some future date an increased volume of traffic would recoup them for the loss incurred by those reductions, but past experience showed that they could not anticipate more than a very gradual growth of traffic on that account. One of the strong features of the company was the variety of sources from which its revenue was derived. If there was a temporary reduction in the receipts from one or more sources owing to reduced rates or other causes they might have a corresponding increase in some other direction, which enabled them as they had done this half-year, to maintain their revenue. In order to earn the same revenue as formerly, it was, of course, necessary to carry a much larger number of words to give the same return, and frequently greater cable carrying capacity was required. Thus to enable them to earn the same revenue under the reduced rate as formerly, it was necessary in the Indian traffic for them to carry 60 per cent. more words, but up to the present the increase had been only 33 per cent., and extra expenses were involved besides a diminution in gross receipts. The ordinary expenses for the half-year amounted to £163,000, as against £150,000, or an increase of about £13,000. About £6,000 of that increase took place during the half-year to September 30th last, and was explained at the last general meeting. The electrical department had been enlarged, and an experimental branch had been properly installed with an outfit of electrical apparatus to enable their experts to test the value and suitability of any new

inventions for improving the speed and accuracy of their system in dealing with the ever-growing volume of work. That department was worked in the joint interest of the whole of the Associated Companies. They contributed towards its cost, and all were kept in touch with the latest improvements in electrical matters. The board had been for some time past impressed with the necessity of their being in the forefront of scientific developments in cable and cable instruments, and decided, in conjunction with the Boards of the Associated Companies, to offer to Sir Oliver Lodge the post of consulting scientific adviser, which, he was glad to say, he had accepted. Sir Oliver Lodge would occupy with them a similar position to that of Lord Rayleigh with the Corporation of the Trinity House, and they would be able to obtain at all times the help and advice of, perhaps, the first electrician of our times to help their efficient and admirable staff in their investigations and care of the scientific interests of the companies. When they decided, in conjunction with the Eastern Extension Telegraph Co. to undertake the establishment of the new cable between Great Britain and Australia, *viâ* the Cape, a considerable increase in the working expenses was fully anticipated. The increases in their expenses were therefore the inevitable result of the policy which they considered advisable to adopt, and he thought it would be agreed that the result fully justified their action. While maintaining the dividend, they had been able to carry substantial contributions to the reserve fund, and add very materially to the earning capacity of the system, thereby giving additional power to their undertaking, both as a State and public serving institution and a dividend-earning corporation. Ten years ago the percentage of ordinary working expenses to revenue (exclusive of repairs to cables) was 22·46, it was now 24·43, or an increase of 2 per cent., which, taking everything into consideration, must be looked upon as very satisfactory. The expenses attending repairs and renewals of cables, &c., this half-year amounted to £27,400, as against £39,800, or a decrease of £12,400. During the half-year they had issued £58,710 4 per cent. mortgage debenture stock and £37,800 3½ per cent. preference stock—a total of £96,510. They had thought it advisable to purchase the cable repairing steamer *Duplex* from the Eastern and South African Telegraph Co.; as the two companies' systems now ran so close together, both on the east and west coast of Africa, that it would be more convenient for them to own the repairing steamers usually stationed on both coasts. Having referred to the recent International Telegraph Convention held in London, Sir John touched upon the subject of wireless telegraphy, and said he had really nothing to add to what he had stated on former occasions. They had always held to the opinion that wireless telegraphy would not rival, but would prove a useful adjunct to submarine telegraphy, and they had installed the system on some of their ships, where they had found it useful for the purpose for which it was evidently suitable. In conclusion, the Chairman referred to the Commercial Pacific Cable, and said he could assure the shareholders that their interests were being carefully guarded in that matter.

Sir JOHN DENISON PENDER, K.C.M.G., seconded the motion which, after a short discussion, was agreed to.

## Dublin United Tramways Co. (1896).

THE report for the half-year ended June 30th last, states that the amount available for division is £36,882, out of which a dividend for the half-year is recommended at the rate of 5 per cent. per annum on the ordinary shares, and a sum of £2,000 has been set aside to reserve fund, leaving £2,857 to be carried forward. The amount charged against revenue of the half-year for rates and taxes again shows an increase of £2,125, as compared with the corresponding period of 1902.

Mr. W. M. MURPHY presided at the meeting held at Dublin on 28th inst., and in moving the adoption of the report, he referred to the encouraging continued increase of £5,610 in their receipts. The traffic receipts actually increased by £5,749, but there was a falling off of £234 in the advertising. The company had effected a saving of £1,093 in the cost of generating electric current. Under the head of general maintenance, there was an increase of £2,754, the increase in the cost of car bodies, car trucks and electrical equipments accounting for £1,467. The maintenance of the engines, electrical plant, boilers, &c., at Ringsend showed a small saving, and there was an increase of nearly £400 under the head of buildings, which was occasioned by making good the effects of the great storm of February last. The increase of £760 in the maintenance of the overhead line was largely due to the same cause. The increase of the traffic expenses of £874 was nearly all in the item of wages, and this was duly accounted for by the fact that the mileage covered by the cars was more than 50,000 miles in excess of last year. The most serious increase in their expenses was due to rates and taxes, which reached within a few shillings of £10,000 for the half-year.

The report was adopted.

## City and South London Railway Co.

MR. C. G. MOTT presided at the meeting of the company on Tuesday, and before moving the adoption of the report, he said that the special extraordinary meeting which had been announced would not be held yet, as their Bill was still awaiting the Royal assent, and they could not create stock until that had been received. The dividend was reduced as compared with the first half of last year; it was exceptionally good last year, owing to the completion of the Islington extension and because the traffic of the L.C.C. tramways, which were then converting to electric traction, was thrown on to this railway. During this half year, however, they had been subjected to very considerable opposition, owing to the improved conditions and low fares on the tramways now that they were working electrically. A great deal of their short-distance traffic had been attracted away by the electric cars, but they recognised that electric tramways were matters which all railways would have to meet, though his own belief was that they would prove rather an accession than a damage to the existing railways. One other reason why they were not able to recommend the same dividend as last year was, that during this half they had had to pay into Court the whole of the amount awarded in connection with the St. Mary Woolnoth Church. The decision, so far, had been altogether inequitable, and they were carrying it to the House of Lords. In the meantime they had had to pay the principal, interest and all charges, but they hoped that they would get a great deal of that back again some day. They had had to issue stocks upon which interest had had to be paid. The chairman then went into the accounts. One of the items was the locomotive expenses, which showed a diminution by £255; but that had to be set against £486 increase in the traffic expenses, for they had been rearranging the accounts and charges in connection with the lifts, so that they might show clearly, in future, the absolute cost of working the lifts. The result of the working was a decrease in the balance available of £1,193; but they had also to meet an increase in the preference dividend, which compelled them to decrease the ordinary stock dividend by ¼ per cent. The miles run during the half year had increased by 2,042, and the number of trains by 333. The passengers per train had increased from 91·03 to 93·8, or 2·77; the receipts per train had increased from 15s. 11d. to 16s. 1·7d., or 2·7d. per train. The receipts per train-mile had been increased by only ¼d.; and those per passenger had slightly decreased, to 1·88d. against 1·93d. That was an unsatisfactory figure, caused by the number of short fares. The working expenses had increased from 44·74 to 46·37 per cent., or 1·63. That was unsatisfactory, but at the same time, 46·37 was a very low rate of working, especially bearing in mind the very large cost of working the lifts. The locomotive charges were 4·47d. against 4·59d. last year, a small decrease; the traffic expenses were 6·29, against 6·13, or a slight increase of ·16. Turning to the report, they were suffering very heavily from the competition on the short-distance fares in the affected district, but on the other parts of the line the traffic was showing decided and steady increases. Since the end of June their traffics had been steadily increasing week by week from the lowest levels which were reached after the tramways got fairly to work. However, their attention was very strongly drawn to the question of altering the fares or otherwise meeting the opposition. They were considering the matter carefully, but at the present moment it was better to hold their hands and see exactly what the result of the further working of the tramways would be. It was perfectly clear that they should devote their attention to the development of the longer distance traffic, because it was that that paid best, and was unaffected by tramways opposition. They had found by the extensions to Islington that the increased length of the line had strengthened them very much, and that portion of the line still showed steady increases of traffic from it. That was an important fact in connections with the proposed extension to St. Pancras and Euston. Last year that Bill was thrown out, but this year they had succeeded in passing it through both Houses, and it now awaited the Royal Assent. After enlarging upon the great importance of this extension to the company, and also referring to the great benefit that they would in time derive from the various connections which they were arranging for with other railways, the chairman formally moved the adoption of the report.

Mr. C. S. GRENFELL seconded.

In reply to questions, the CHAIRMAN said that the new capital needed would probably be about £400,000, half in ordinary and half in preference shares. They would not want the money yet awhile, and would wait for a favourable opportunity for making the issue. The proposal for a 4 per cent. convertible preference share suggested by Mr. Brown should have their serious consideration, but under their Act they were bound to issue a certain proportion as ordinary capital.

The resolution was passed unanimously, also that relating to dividends.

The meeting closed with a very cordial vote of thanks.

## National Telephone Co.

SIR H. FOWLER presided on July 23rd at the meeting of this company.

The CHAIRMAN, in proposing the adoption of the report, reminded the shareholders that this was only a half-yearly meeting, and the accounts were necessarily, so far as the last two or three weeks of the half-year were concerned, estimates. Those estimates were, however, always taken much under the mark, and from what had transpired since, the directors were fully satisfied that the report represented the position of the company. The income accrued in respect of the business of the half-year amounted to £894,046, which compared with £823,243 for the corresponding period of 1902—an increase of £70,803. The working expenses had amounted to £516,000, or an increase of £38,020. The rates and taxes had increased, and so had the insurance; and naturally, with an increased business, they had to employ a larger staff, which necessitated an increase in wages. The staff had been increased by 600 during the half-year, and the number of officials in the employ of the company was now 12,064. The net result of the half-year was a profit of £377,994, but out of that they had to pay £81,930 to the Post Office

by way of royalties. That was a very heavy burden upon their income, and although they had an increase of £32,873 in their profit, that was reduced to £26,618, owing to the extra royalties they had to pay. The rentals carried forward for unexpired terms of running contracts amounted to £874,383 as against £821,397 at the corresponding period of 1902. The board proposed to pay a half-year's dividend at the rate of 6 per cent. per annum on the first and second preference shares, 5 per cent. per annum on the third preference shares, 6 per cent. per annum on the preferred stock, and 5 per cent. per annum on the deferred stock. Hitherto they had been paying 4½ per cent., but this time they had been able to pay an additional ½ per cent., and the idea of the board and the shareholders, which they had approved over and over again, was to take the income at 5 per cent. That was the dividend at the time the shares divided, and as the shareholders received 6 per cent. on one-third and 4½ per cent. on two-thirds, that practically made 5 per cent. There was a general feeling expressed at the last meeting that, if they had a good half-year, the deferred shareholders would like to see their dividend raised to 5 per cent. The board concurred in that view, and had adopted it. Some shareholders, while expressing their approval of that course, had thought it should be more, and one had suggested that it might have been raised to 6 per cent. He could only repeat what he said last year—that they were adding more largely to the reserve fund, and this year they were carrying £105,000 to that fund as compared with £70,000 at June, 1902. He told them last year, and he wished to repeat it, that while the reserve fund was in a very healthy state, its amount was entirely a question of policy. If the shareholders took the money now they could not have it at a later date. The financial strength of the company lay in its reserve fund, and he strongly advised the shareholders not to look in the direction of increasing their dividends, but in building up that fund. His own opinion on the matter was that, as far as the minimum was concerned, they ought to see their way clear to adding £200,000 a year to the reserve as their time was running out—they were approaching 1911. He was certain that the position of the company depended, to a great extent, on the reserve fund. The board had raised the dividend this half-year, but he did not wish it to go forward that there was anything like reasonable expectation held out that the dividend would be again increased, unless some prosperity should come upon them which at present they could not foresee. He thought the shareholders would consider that the position of the company was satisfactory both as regarded the condition of its plant and of the staff. During the half-year they had expended £334,115 on new plant, and, in addition, had kept up the existing plant by the expenditure of a larger sum by many thousands of pounds than in the corresponding six months to keep it in a state of thorough efficiency. In a company like theirs, everything depended upon the plant being kept up to its full value, and as in telephone instruments and plants there was, perhaps, a more rapid depreciation than in many other classes of plant, it was impossible to apply the ordinary rules of depreciation in their case, and they were quite justified in taking large sums from revenue in order to keep the plant up to its present state of working efficiency. He was pleased to say that their agreement in London was working most satisfactorily, and they were increasing their business in a very satisfactory manner. The Post Office were also increasing their business in London very considerably, which justified what had frequently been said at those meetings, that there was room for both systems. In conclusion, the Chairman stated that during the last year the number of telephone messages which the company transmitted reached the enormous total of 922,875,000, as compared with 787,311,000 for the year 1901-2. Against that, the number of telegrams transmitted by the Post Office for the year ending March 31st, 1902, was 82,000,000, so that they had considerably more than 10 times more messages sent over their telephone system as compared with the telegraph.

Mr. G. Franklin seconded the motion, and the report was adopted.

## Edmundson's Electricity Corporation, Ltd.

This company's meeting, held at Westminster on July 23rd, was presided over by Mr. Francis E. Gripper, M.I.E.E. (managing director).

The Chairman, in moving the adoption of the report, said that the result of the year's trading was a net profit of £26,226. In addition to trading profit, they had received £15,845 interest on investments, which was £3,000 more than was received under this heading last year. They had a further profit resulting from the realisation of investments, amounting to £14,785. This profit arose principally from the sale of the Woolwich undertaking to the Corporation of Woolwich. That sale had now been completed, with the result that the shareholders received about £2 6s. for each £1 share. £4,000 of this profit had not been received at the end of the year, and it will appear in the next account. The total profits thus amounted to £56,954, to which must be added the balance brought forward from last year of £6,179. After paying the interest on debenture stock and the preference dividends, and interim dividend already paid on the ordinary shares, there remained £37,257 to be dealt with. The directors recommended that £5,000 be written off the goodwill account, that the sum of £9,274 be added to reserve, and that a dividend at the rate of 9 per cent. per annum for the half-year be paid on the ordinary shares, making a total distribution of 7 per cent. for the year. This would leave £11,733, a larger amount than usual, to be carried forward. During the year, issues had been made of preference shares and debenture stock, and the premiums on these issues, amounting to £16,725, had been added to reserve. The reserve was now increased from £14,000 to £40,000. The new capital had been required for the completion of new works and the extensions necessary to existing ones. The investments in subsidiary companies were £607,610, taken at cost price. This was nearly £120,000 less than the par value. Since the last report they had completed and opened new electricity works in nine fresh towns. At Hamilton and Cromer the works had been carried out for the local authorities, who were finding all the necessary capital, and leasing the works, when completed, to this company for a term of years. Four new works had been opened for the Urban Electric Supply Co. at Dartmouth, Newton Abbot, Grantham, and Camborne, the latter undertaking including the tramway between Camborne and Redruth. A substation had been opened at Cowes in the Isle of Wight, which was being supplied from their works at Newport, and from this station they had arranged to give a large supply to the Osborne Estate, in connection with the new Naval College, which was being established there. The other new works completed had been at Ilfracombe and Market Drayton, the latter being a small town, for which local subscribers have found the whole of the necessary capital. Large extensions have been carried out in connection with their undertaking at Guernsey, in order to provide for a supply of electric power for use in the granite quarries, and contracts had been entered into with some of the principal quarry owners for a large supply of electric power. Very encouraging progress had been made during the year in the development of all the undertakings. They had now 28 central stations actually at work, and during the year just ended the increase in the lamp connections had been over 163,000, with an additional 38,000 applied for and waiting connection. The advantages in working a number of undertakings under one management were becoming more and more apparent. Not only were economies possible, both in first cost and in working charges, but the results obtained in one place were frequently of great value in dealing with others. With regard to the future, the most important new work in view was in connection with the Lancashire Electric Power Co. They had taken an interest in the Lancashire Electric Power Construction Co., which was contracting to erect works for the Lancashire Electric Power Co. Their total interest in this company would, in a year or two's time, probably amount to about £60,000, and they believed their connection therewith would prove of a very profitable nature. They had also entered into a contract for the complete equipment of electric tramways at Scarborough, and the work would be commenced in October next.

Mr. W. R. Davies seconded the adoption of the report, and it was carried unanimously.

The re-election of a director, and the sending of a message of sympathy to the chairman of the company in his illness, brought the meeting to a close.

## Direct United States Cable Co.

Mr. E. M. Underdown, K.C., presided at the meeting held at Winchester House on Tuesday, and, in moving the adoption of the report, he said that the revenue showed an improvement of £2,276 over the corresponding period, notwithstanding the keen competition which had existed, and still exists, in Atlantic telegraphy. The working expenses in London were practically the same as last year, but the expenses at stations involved several increases, extra outlay having been made upon maintenance and renewal account, repairs to station buildings, &c. The total expenditure showed a net increase of £209 as against an increase of £2,276 in revenue. The investments stood at £449,231, or £882 less than last year. After summarising the business for the whole year, the chairman said that they were fortunate to be able to lay such a statement before them. For some time they were extremely fortunate in freedom from repairs and renewals of cables. They must expect from time to time to have to bear expenses under that head, and for that purpose they had the reserve fund, which, after debiting it with £22,932, cost of repairs for the half-year, stood at £474,664. During the whole of their 26 years' working, they had received in interest upon the reserve fund £255,532, or an annual average of £9,828. During that time there had been spent in repairs £228,829, or an annual average of £8,800. During repairs and interruptions from whatever cause, the company practically retained its same earnings, because it shared in the earnings of the pool companies. They had taken up the cable from a depth of 2,050 fathoms (really 2½ English miles), and it had been found to be in good condition, and had put in pieces at different places; this was a proof that cables laid at great depths could be dealt with. In regard to Marconi and other wireless telegraph enterprises, they never did, and they did not now, consider that it was to be taken seriously into consideration with regard to traffic across the Atlantic cables. After a few words respecting the International Telegraph Conference,

Sir James Pender seconded the motion, which was carried unanimously.

The re-election of directors and auditors, and a vote of thanks to the board and staff, brought the meeting to a close.

**Stock Exchange Notices.**—Applications have been made to appoint a special settling day in and to grant a quotation to:—British Westinghouse Electric and Manufacturing Co., Ltd.—Further issue of 100,000 6 per cent. preference shares of £5 each, fully paid. Metropolitan Electric Supply Co., Ltd.—71,083 4½ per cent. cumulative preference shares of £5 each, fully and partly paid. Underground Electric Railways Co. of London, Ltd.—Fully and partly-paid provisional certificates for £7,000,000 5 per cent. profit-sharing secured notes.

## Anglo-American Telegraph Co.

The directors' report to be presented at the half-yearly meeting at Winchester House on Friday, July 31st, reads as follows:—

The total receipts from January 1st to June 30th, 1903, including the balance of £1,706 7s. 9d. brought forward from the last account, amounted to £14,361 3s. 6d. The traffic receipts show an increase of £9,297 as compared with the half-year ended June 30th, 1902. The total expenses of the half-year, including the repair of cables, &c., as shown by the revenue account, amounted £65,893 2s. 10d., being an increase of £6,962 10s. 6d. as compared with the corresponding period of 1902. The cost of the repair of the 1873 cable to June 30th, amounting to £12,190 7s. 1d., has been charged to the renewal fund. The directors, under the powers conferred upon them by the articles of association, have, before declaring the net profits, set apart the sum of £12,000 to the renewal fund, leaving a balance of £103,468 0s. 8d. One quarterly interim dividend of 15s. per cent. on the ordinary stock, and of £1 10s. per cent. on the preferred stock, was paid on May 1st, 1903, absorbing £52,500, and a second quarterly dividend of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock, amounting to £52,500, will be paid on August 1st, 1903. The balance of £1,468 0s. 8d. will be carried forward to the next account. The cables and landlines of the company are in good working order.

## The General Electric Co., Ltd.

Mr. G. Byng presided at the meeting of the company held last Friday at 71, Queen Victoria Street. In moving the adoption of the report he said:—

"The feature of this year's balance-sheet is this—that all the money we obtained on becoming a public company, and also some of our profits, has now been invested for the purpose stated in our prospectus, that is, for building up a large manufacturing establishment at Witton, near Birmingham. The item of £83,558 is almost entirely composed of additions to the buildings and plant at our Witton Works. We have so far spent upon the Witton Works the sum of about a quarter of a million pounds sterling, and we have created there factories which, in most respects, compare favourably with the best factories existing in England. To the large engineering and carbon works, we have added during the year the extensions to the iron foundry and the tube works.

"These magnificent new works of ours are doing credit to that spirit of enterprise and energy which has characterised the management of our firm from its inception. The next item is sundry debtors, which is reduced by about £18,000 compared to last year. Such items, as you know, usually fluctuate in the course of business, and this only shows that some of our larger customers have paid up more quickly this year than last year. Our stock in trade, which now exceeds a quarter of a million pounds, is considerably higher than last year, the increase being the sum of £37,000. This is mainly due to the stock carried at Witton and to the opening of the two new branches. The investments stand at £43,000 against £47,000 last year. The reduction is due to the writing off of the shares of one of our subsidiary companies. We have, on the other hand, not appreciated any of the other shares, which have again proved highly remunerative, and which we consider are worth a good deal more than the amount at which they stand in our books. The fact—which you can see for yourself—that these investments have brought in an income exceeding 10 per cent. must prove that they are good investments.

"Now I come to the profit and loss account. If we compare the top items on the three balance-sheets which we have issued, and which item represents the general trading profits, we find that they have steadily increased. They were in 1901, £70,000; in 1902, £81,000; and this year they are £90,000. They show that our business generally is healthy and progressive; but, on the other hand, I am sorry to say that we have to record a loss of £20,000, which reduces the profits to be divided considerably. This loss has occurred at our Witton Works. I have said already what fine works these are, and it does not seem in harmony with this statement now to recall a loss during the first year's working. I wish to explain that, while one always expects some loss during the establishing of such a large enterprise, yet the major part of this £20,000 is due to exceptional circumstances, and really in no way takes anything off from the fact that the works themselves are in good condition. Matters have generally mended at Witton, and we need not be afraid of a recurrence of such a loss. I do not expect any profit from the carbon works during this year, but, in fact, a small loss again; yet the engineering works are very full with orders, and I believe they will help us to increase the profits to a large extent during this year. You will notice that the whole of this loss, which we have written off, is practically borne by the holders of the ordinary shares, who are in consequence receiving 5 per cent. only, instead of 10 per cent., which they have had during the previous years. It has always been the object of your directors to see that our preference shareholders should have the best security possible, and that the full amount of the ordinary shares that are behind them should be represented by liquid and tangible assets. This will be the case as soon as our reserve fund reaches the sum of £92,000, which is the amount standing under the heading of goodwill on the other side. You will notice that we are adding a further £21,000 to the reserve, bringing the same up to over £60,000, and we hope that our next year's working will allow us to place another large amount to our reserve so that the amount standing against goodwill will be balanced by our reserve. The largest amount of the Witton deficit comes from the carbon works, and it is mainly due to what must be called unfair foreign competition. I would not under ordinary circumstances have entertained you much upon this question, but as it is one which is now a practical issue before the country, I think a few words regarding it would serve to enlighten both our shareholders and, perhaps, the country at large. We started our carbon works because we were entirely depending upon German manufacturers. This was a dangerous position to be in, both from a business and a patriotic point of view. Our Government, especially the Admiralty, have themselves urged us to establish these works. The importance of making carbons in England is obvious. We have nearly a million arc lamps in the country, our men of war—our coast defences—depend on electric light carbons. A man of war without a search light would be like a man without eyes—yet we spend a million pounds sterling on a man of war, and we depend on foreign manufacturers for the carbons, which cost but a fraction, yet are so indispensable. This would be a source of great danger in case of war.

"After three years of hard work our carbon factory is now in full swing. We have spent over £60,000 in its erection; we have taught several hundred workpeople a new industry, and we have made a vast number of experiments, which, as you will see, have cost us a further sum, which we are now writing off. We are now making carbons, equal and even better in quality than the Germans, and this is what has happened since the establishment of our factory. The three largest foreign manufacturers have decided to reduce their prices to a level which should be unremunerative to us, and with a view of killing the British manufacturer, are prepared to work at a loss to themselves in this country until they have achieved this object. I must say that we have the assurance of the Admiralty, War Office, and many other Government and public bodies that they will support us in spite of the price regulated by such indicated foreign policy, and with this help and being able to obtain the raw material at a lower price than the Germans can obtain it, I still trust to be able to keep the carbon factory going until the time comes when the country sees the folly of free imports directed solely against the English manufacturer. This experience of ours in carbons must prove to anybody that the establishing of a new industry in this country is practically an impossibility under the present system. Let Englishmen note that that which keeps a nation alive and energetic, its brain-work active, and its workmen instructed and skilled, is the production of new invention. They will have to choose between sticking to the obsolete policy of doing nothing or the policy of supporting their home producers upon the same lines as other nations do. Finally, let me say to you that I hope sincerely we manufacturers will come into our own eventually, that is, our legitimate share both in our home and colonial market. If such is the case you may see our large works extended enormously, and the number of our workmen, which now reaches about 6,000, doubled very shortly. I know it has been said that we manufacturers want Protection to enrich ourselves, but I can see no harm or crime in trying to get rich by honest labour, in which thousands of our fellow subjects must share. I say more, I say that the welfare of the country depends on such selfishness of the individual manufacturer."

Mr. M. Byng seconded the adoption of the report.

A Shareholder asked:—"Do you say that these Witton Works will not be profitable unless we have Protection?"

The Chairman: A number of public bodies have promised to support us in respect to price, but we must not rely upon that too much. If we do not get Protection in a few years' time it will be quite impossible to keep them going, except at a great loss, which you will see, by the balance-sheet, we can afford. We are not going to stand a big loss every year for the public benefit. The carbon works will be shut up, unless we get Protection.

The Shareholder: Was it not an unwise thing to start these carbon works?

The Chairman: Most unwise of me.

Mr. G. A. Touch, consultative auditor, said that the balance-sheet was a most satisfactory one from the preference shareholders' point of view, notwithstanding the loss at Witton. He spoke words of high praise in respect of the management, and of the manner in which the profits had been dealt with. He then congratulated Mr. Byng upon the pioneering work he had done in connection with "Protection," and discoursed upon the subject at some length. He said that they who went up and down the country among our industries recognised that some modification of our present inelastic system was needed. No new industries had been established in this country for a great many years. But it was not only in the case of new industries, but in many of the existing ones, that a small and moderate measure of Protection, carefully applied, would be able to give employment to thousands of workmen. After referring to the evils of foreign competition, he remarked that it was also true that an excessive measure of Protection was as likely to be as disastrous to trade, or to some branches of it, as was our present Free Trade. In America it had been shown that extreme Protection had led to the setting up of disastrous competition.

The report was adopted.

The motion for the re-election of Messrs. G. A. Touch & Co. (as consultative auditors) and Messrs. Edwin Guthrie & Co. (as auditors) was passed, and

Mr. Guthrie, in acknowledging, said that he did not propose to enter into the political question mentioned by Mr. Touch. But his views were not those of Mr. Touch, nor those of the chairman. He had sent his views to be read out at the Manchester Free Trade Hall that night. He would say this, however, that in America they had a practical illustration of how soon the advantages to the individual, arising out of Protection, disappeared. If they had a business giving 50 per cent. profit and established Protection, they would soon find others appreciating that it was a good thing, and other firms would start in the same line, with the result that the competition would reduce the profit.

In moving a vote of thanks to the chairman, the shareholder who had previously spoken said that the prosperity of the company was not in such great danger. He thought that if Free Trade were continued, they would have a very prosperous career.

[Previous to the meeting, in the course of a conversation with members of the Press, Mr. G. Byng asked for it to be told to the world that "they, as manufacturers, resented being talked to by men of no experience."]

## Waterloo and City Railway Co.

The report for the half-year ended June 30th last, to be submitted at the meeting on the 6th prox., states that there has been no change in capital account during the half-year. Gross receipts, less Government duty, amounted to £17,438, and the working expenses to £8,022, being at the rate of 46 per cent., as compared with 44·84 per cent. for the corresponding period of 1902. The balance available for dividend, after providing for interest on debenture stock, is £8,945, and a dividend at the rate of 3¼ per cent. per annum on the ordinary stock is recommended, leaving £170 to be carried forward. The number of passengers carried during the past six months, exclusive of season ticket holders, was 2,281,133, showing an increase of 41,739 over the number carried in the corresponding period of 1902. The season-ticket holders on June 30th last numbered 1,244, as against 1,197 at the end of June, 1902.

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**Great Northern and City Railway Co.**—The report for the half-year ended June 30th states that the main line from Moorgate Street through Old Street and Essex Road to Drayton Park station is now almost completed. The extension from Drayton Park to Finsbury Park is in a forward state, and the whole of the tunnels are expected to be completed by the end of August. The various and complicated arrangements at Finsbury Park station are in a forward state, and, it is expected, will be completed by the end of the year. The station at Highbury is in course of construction. Preliminary arrangements are being made for an early commencement of the extension from Moorgate Street to the Bank at Lothbury. The electrical installation is completed and ready for working.

**Bristol Tramways and Carriage Co.**—The directors have declared an interim dividend to June 30th at 8½ per cent. per annum, and warrants will be posted on August 7th. The total receipts of the company for the half-year were £121,934 against £111,849, an increase of £10,085 over the corresponding period, whilst the number of passengers carried was 21,398,765 against 19,523,245, an increase of 1,875,520. The interest on debenture stock, the preference dividend and interim dividend of 8½ per cent. per annum absorbs £35,317 against £34,075 in the corresponding period.

**Crompton & Co.**—The report for the year ended March 31st last, to be presented at the meeting on the 5th prox., states that net profit for the year amounts to £19,804, and after providing for debenture interest, the payment of the interim dividend and other items, there remains, with the sum brought forward from last year, a balance of £7,473. The directors propose to pay a final dividend at the rate of 5 per cent. per annum for the half-year, making, with the interim dividend paid in January last, 5 per cent. for the year, and to carry forward a balance of £1,098.

**Liverpool Overhead Railway Co.**—The accounts for the past half-year show an available balance of £9,872, and the directors have resolved to recommend payment of a dividend at the rate of 5 per cent. per annum on the preference shares, and 1½ per cent. per annum on the ordinary shares, against 1 per cent. per annum on the ordinary shares for the corresponding period last year. Balance carried forward £3,747.

**County of London and Brush Provincial Electric Lighting Co.**—The directors have declared an interim dividend for the half-year ended June 30th, 1903, on the ordinary shares, at the rate of 4 per cent. per annum. The amount of electricity sold in the company's London districts during the half-year is estimated to realise £49,824, which compares with £43,725 for the corresponding period of last year.

**Central London Railway.**—The directors have declared a dividend for the past half-year at the rate of 4 per cent. per annum, carrying forward £45,400. A year ago the distribution was at the same rate, with £25,600 carried forward.

**Metropolitan Electric Supply Co.**—The directors have declared an interim dividend for the half-year ended June 30th last at the rate of 8 per cent. per annum, as compared with 7 per cent. last year.

**South London Electric Supply Corporation.**—The accounts for the half-year ended June 30th show a net profit of £5,210, against £2,548 for the corresponding six months of last year.

**National Gas Engine Co.**—The directors have resolved to pay an interim dividend at the rate of 15 per cent. per annum on the ordinary shares for the six months ended June 30th last.

**Westminster Electric Supply Corporation.**—Interim dividend for the half-year ending 30th ult. at the rate of 13 per cent. per annum.

## STOCKS AND SHARES.

Wednesday Evening.

Nemesis long-threatened seemed at length about to fall upon the artificial American railroad market, and the whole Stock Exchange shivered in the earlier part of the week at the concatenation of unfavourable circumstances that played havoc with its quotations in very nearly every section. Fears that the Far East would let slip the dogs of war, rumours of assassination in the palaces of the Near East, and hurried closing of weak Stock Exchange accounts—each of these in itself is sufficient reason for nervous markets, and coming in conjunction, as they have done, it is merely surprising that some sort of semi-panic has not overtaken Capel Court. The departments with which we deal are, of course, sheltered from a good many of the unfavourable winds that blow, and the changes on the week again demonstrate the quiet strength of such purely investment markets as are the electricity supply and its adjacent divisions.

With Home Railway stocks visibly affected by the continued fall in Consols, a slight weakness in the electric stocks is only what might have been expected. City and South London, however, appears to have discounted future losses in its current quotation, and while the prospective buyer might hesitate about buying just now, there does not seem much chance of a further heavy decline. Waterloo and City stock is to receive that additional dividend which we were rash enough to forecast a fortnight ago, and it may be taken for granted that the stock is now on a 3¼ per cent. basis at the least. The price keeps steadily about par.

Central London issues have not been much affected by the dividend of which mention was made in our last notes. Travellers who habitually use the line are somewhat divided in opinion as to whether the new devices for "airing" the line are of much use at present. The District Railway again reduces its fares on August 1st, and has started an extra service of trains on Sunday; much curiosity is awakened as to the result likely to be achieved by this enterprise. Maybe the District directors will even, some day, take steps to prevent the periodical flooding of their railway stations west of Earl's Court. The Manchester and Liverpool Mono-Rail shares are not mentioned in the market; that is to say, as regards quotations.

The excellent advance in dividend announced by the Westminster Electric Supply Co. has had a hardening effect upon the price of the shares, which are 10s. to the good, although the Preference are ¼ easier. Unhappily, the announcement was preceded by buying that had all the appearance of inspiration, and it would be indeed a pity if such a clean-handed market as that devoted to electric supply shares were to come under suspicion by early information of an important character in reference to any company leaking out before it is communicated to the public at large. Of course, there is the possibility that the early buying ahead of a larger dividend was but a coincidence; still, it is impossible to take too much care in connection with such matters.

St. James's and Pall Mall Ordinary have declined ¼, losing their recent rise, and Brush Preference came to market the other day, reducing the price to 1¼. Electric Constructions have also lost ¼, but the Telegraph Industrials are unaltered. Metropolitans are no better, despite the good dividend.

The Telegraph market sturdily maintains its strength, and the collapse in other directions has had practically no effect. Indeed there are half-a-dozen rises to record, and no falls, although a good many stocks are *ex* dividend. The Anglo-American group looked on at the Yankee market agitations with unmoved equanimity. Eastern Ordinary is about a point harder on the report, and several of the Debenture stocks have moved up. Cuba Telegraph Preference continue to receive support, so that it may be seen how the recent purchasers regard their newly-acquired investments. Marconi shares are a dullish market at 2¼.

National Telephone Deferred reflects the weak state of most of the speculative departments, but its relapse is quite small, and the other telephone descriptions exhibit no change on the week. Great and unusual obstacles nowadays beset British Corporations in making issues of new stock, and the refusal of underwriters to entertain any more of such offers, has produced something like consternation in many council chambers and town halls round the country. The eagerness with which corporation and municipal bodies have embarked, and are still embarking, upon electric enterprises, has received a severe check during the past week from this difficulty of raising funds. In time, no doubt, the undigested stocks of past issues will gradually filter into investors' hands, but until the private capitalist begins to take renewed interest in such securities, local expenditure must necessarily be checked in a good many directions.

British Electric Tractions of both classes have receded, the Ordinary ⅛ and the Preference ¼; while London United Tramways Preference remain at 12, a fresh record in Bank Holiday receipts being anticipated. Dublin United Trams are 13½ and 15½ for Ordinary and Preference respectively, the royal visit to Ireland producing no change. Provincial and foreign tramway issues are all steady.

# SHARE LIST OF ELECTRICAL COMPANIES.

## TELEGRAPH AND TELEPHONE COMPANIES.

| Present Issue. | NAME. | Stock or Share. ‡ | Dividends for the last three years. 1900. | 1901. | 1902. | Closing Quotations July 22nd. | Closing Quotations July 29th. | Business done week ended July 29th, 1903. Highest | Lowest |
|---|---|---|---|---|---|---|---|---|---|
| 67,100 | African Direct Telegraph, 4 % Debs. | 100 | .. | .. | .. | 98 —102 | 98 —102 | .. | .. |
| 25,000 | Amazon Telegraph Co.'s shares, Nos. 1 to 25,000 | 10 | .. | .. | .. | 2⅛ — 3⅛ | 2⅛ — 3⅛ | .. | .. |
| 119,700£ | Do. do. 5 % Debs., Nos. 1 to 1,250 Red. | 100 | .. | .. | .. | 70 — 80 | 70 — 80 | .. | .. |
| 788,840 | Anglo-American Telegraph | Stock | 3¾% | 6l8. | 60/6 | 48 — 51 | 47 — 50 xd | 48 | .. |
| 3,105,580 | Do. do. do. 6 % Pref. | Stock | 6 % | 6 % | 6 % | 93 — 95 | 92 — 94 xd | 94½ | 93½ |
| 3,105,580 | Do. do. do. Deferred | Stock | 5s. % | 2s. | 1/- | 8¾ — 9 | 8¾ — 9 | 8½ | .. |
| 44,000 | Chili Telephone, Nos. 1 to 44,000 | 5 | 5 % | 5 % | 6 % | 4⅞ — 5⅛ | 4⅞ — 5 xd | .. | .. |
| 13,333,300$ | Commercial Cable | $100 | 8 % | 8 % | 8 % | 150 —160 | 150 —160 | .. | .. |
| 1,841,209 | Do. do. Sterling 500 year 4 % Deb. Stock Red. | Stock | .. | .. | .. | 92 — 95 | 92 — 95 | 92 | .. |
| 16,000 | Cuba Telegraph | 10 | 4½% | 4 % | 6¼% | 6½ — 7½ | 6½ — 7½ | .. | .. |
| 6,000 | Do. 10 % Pref. | 10 | .. | .. | .. | 15½ — 16½ | 17 — 18 | .. | .. |
| 12,931 | Direct Spanish Telegraph | 5 | 4 % | 4 % | 4 % | 2⅞ — 3⅛ | 2⅞ — 3⅛ | .. | .. |
| 6,000 | Do. do. 10 % Cum. Pref. | 5 | .. | .. | .. | 7 — 8 | 6½ — 7½ | .. | .. |
| 90,000 | Do. do. 4½ % Debs. | 50 | .. | .. | .. | 97 —101 | 97 —101 % | .. | .. |
| 60,710£ | Direct United States Cable | 20 | 3½% | 3½% | 3½% | 10¼ — 10⅝ | 10 — 10¼ xd | 10¼ | 10⅛ |
| 87,800 | Direct West India Cable, 4½% Reg. Deb., within Nos. 1 to 1,200, Red. | 100 | .. | .. | .. | 98 —101 | 99 —102 | .. | .. |
| 4,000,000 | Eastern Telegraph, Ord. Stock | Stock | 7 % | 7 % | 7 % | 128 —133 | 129 —134 | 132½ | 128½ |
| 1,955,565 | Do. 8½ % Pref. Stock | 100 | .. | .. | .. | 89 — 92 | 88 — 91 xd | 90½ | .. |
| 1,534,645 | Do. 4 % Mort. Deb. Stock Red. | Stock | .. | .. | .. | 105 —108 | 105 —108 | 107 | 106½ |
| 300,000 | Eastern Extension, Australasia, and China Telegraph | 10 | 7 % | 7 % | 7 % | 12 — 12½ xd | 12 — 12½ | 12¼ | .. |
| 320,000£ | Do. 4 % Deb. Stock | Stock | .. | .. | .. | 106 —109 | 104 —107 xd | .. | .. |
| 300,000 | Eastern & South African Tele., 4% Mt. Db., Nos. 1 to 3,000, red. 1909 | 100 | .. | .. | .. | 99 —102 | 100 —103 | .. | .. |
| 200,000£ | Do. do. 4 % Reg. Mort. Debs. (Mauritius Sub.) 1 to 8,000 | 25 | .. | .. | .. | 99 —102 | 100 —103 | .. | .. |
| 180,227 | Globe Telegraph and Trust | 10 | 5½% | 5½% | .. | 9 — 9¼ | 9 — 9¼ xd | 9⅜ | 9¼ |
| 180,042 | Do. do. 6 % Pref. | 10 | .. | .. | .. | 13 — 13½ | 12⅞ — 13½ xd | 13½ | 13¼ |
| 150,000 | Great Northern Telegraph, of Copenhagen | 10 | 15 % | 15 % | 12½% | 22 — 23 | 22 — 23 | 22⅝ | .. |
| 62,500£ | Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red. | 100 | .. | .. | .. | 98 —101 | 99 —102 | .. | .. |
| 17,000 | Indo-European Telegraph | 25 | 10 % | 10 % | 10% | 35 — 39 | 35 — 39 | 37½ | .. |
| 100,000£ | London Platino-Brazilian Telegraph, 6 % Debs. | 100 | .. | .. | .. | 100 —104 | 100 —104 | .. | .. |
| 1,983,333 | National Telephone, Pref. Stock | 100 | 5 % | 5 % | 6 % | 102 —104 | 100 —102 xd | 104 | 101 |
| 1,966,667 | Do. do. Def. Stock | 100 | .. | .. | 4½% | 82 — 84 | 79 — 81 xd | 83 | 82 |
| 15,000 | Do. do. 6 % Cum. 1st Pref. | 10 | 6 % | 6 % | 6 % | 13 — 14 | 13 — 14 xd | .. | .. |
| 15,000 | Do. do. 6 % Cum. 2nd Pref. | 10 | 6 % | 6 % | 6 % | 12½ — 13½ | 12½ — 13¾ xd | .. | .. |
| 2,250,000 | Do. do. 5 % Non-cum. 3rd. Pref., 1 to 250,000 | 5 | 5 % | 5 % | 5 % | 5⅛ — 5⅜ | 5 — 5⅛ xd | 5⅛ | 5 5/16 |
| 000,000£ | Do. do. 3¼ % Deb. Stock Red. | Stock | 3¼% | 3¼% | 3¼% | 96 — 98 | 96 — 98 | .. | .. |
| 600,000 | Do. do. 4 % Deb. Stock Red. | 100 | 4 % | 4 % | 4 % | 101 —103 | 101 —103 | 103 | 102½ |
| 171,504 | Oriental Telephone and Elec. Nos. 1 to 171,504, fully paid | 1 | 6 % | 6 % | 6 % | ⅛ — ⅜ | ⅛ — ⅜ | .. | .. |
| 100,000£ | Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000 | 100 | .. | .. | .. | 97 —100 | 97 —100 | .. | .. |
| 11,889 | Reuter's | 8 | 5 % | 5 % | .. | 6½ — 7½ | 6½ — 7½ | .. | .. |
| 3,303 | Submarine Cables Trust | Cert. | .. | .. | .. | 113 —118 | 112 —117 | .. | .. |
| 58,000 | United River Plate Telephone | 5 | 7 % | 7 % | 7 % | 5½ — 6 xd | 5½ — 6 | .. | .. |
| 40,000 | Do. do. 5 % Cum. Pref., Nos. 1 to 40,000 | 5 | .. | .. | .. | 4½ — 5½ | 4½ — 5½ | 5⅛ | .. |
| 179,947£ | Do. do. 5 % Debs. | Stock | .. | .. | .. | 104 —107 | 104 —107 | .. | .. |
| 15,609 | West African Telegraph, Shares | 10 | .. | .. | 2 % | 5 — 6 | 5 — 6 | 5⅛ | .. |
| 150,000£ | West Coast of America, 4% Debs., 1 to 1,500 guar. by Braz. Sub. Tel. | 100 | .. | .. | .. | 95 — 98 | 95 — 98 | .. | .. |
| 267,930 | Western Telegraph, Ltd., Nos. 1 to 267,930 | 10 | 7 % | 7 % | .. | 12 — 12⅛ | 12 — 12⅛ | 12⅛ | 12 |
| 75,000£ | Do. do. 5 % Debs. 2nd series, 1906 | 100 | .. | .. | .. | 100 —103 | 100 —103 | .. | .. |
| 400,000 | Do. do. 4 % Deb. Stock Red. | 100 | .. | .. | .. | 97 —100 | 97 —100 | 98½ | .. |
| 88,321 | West India and Panama Telegraph | 10 | ¼% | .. | .. | ⅛ — ¼ | ⅛ — ¼ | .. | .. |
| 84,563 | Do. do. do. 6 % Cum. 1st Pref. | 10 | .. | .. | .. | 6½ — 7 | 6½ — 7 | .. | .. |
| 4,669 | Do. do. do. 6 % Cum. 2nd Pref. | 10 | .. | .. | .. | 4 — 5 | 3 — 4 | .. | .. |
| 80,000£ | Do. do. do. 5 % Debs., Nos. 1 to 1,800 | 100 | .. | .. | .. | 98 —101 | 98 —101 | .. | .. |

## ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 20,000 | British Aluminium 7 % Cum. Pref. | 10 | .. | .. | .. | 3 — 4 | 3 — 4 | .. | .. |
| 900,000£ | Do. do. 5 % 1st Mort. Deb. Stock Red. | Stock | .. | .. | .. | 77 — 82 | 77 — 82 | .. | .. |
| 100,000 | British Electric Traction | 10 | 9 % | 9 % | 8 % | 11⅜ — 12⅛ xd | 11⅜ — 11⅝ | 12 | 11⅜ |
| 100,000 | Do. do. 6 % Cum. Pref. | 10 | .. | .. | .. | 11⅜ — 12⅛ | 11⅜ — 12 | 11⅝ | 11 11/16 |
| 600,000£ | Do. do. 5 % Perpetual Debenture Stock | Stock | .. | .. | .. | 122 —125 | 122 —125 | 124½ | .. |
| 100,000 | British Insulated and Helsby Cables | 5 | 15 % | 10 % | 10 % | 6⅞ — 7⅛ | 6⅞ — 7⅛ | .. | .. |
| 100,000 | Do. do. 6 % Cum. Pref. | 5 | .. | .. | .. | 5⅛ — 6 | 5⅛ — 5⅜ xd | .. | .. |
| 50,000 | Do. do. 4½ % 1st Mort. Deb. Red. | 100 | .. | .. | .. | 102 —106 | 102 —106 | .. | .. |
| 50,000 | ¶Brownett, Lindley & Co., Ord. | £1 | 8 % | Nil | .. | 1/16 — 1/8 | 1/16 — 1/8 | .. | .. |
| 50,000 | ¶ Do. do. 6 % Cum. Pref. | £1 | 6 % | 6 % | .. | 14/6 to 15/6 | 14/6 to 15/6 | .. | .. |
| 105,731 | Brush Electrical Engineering, Ord., 1 to 105,731 | 2 | 5 % | Nil | Nil | ¾ — 1⅛ | ¾ — 1⅛ | .. | .. |
| 150,000 | Do. do. Non-cum. 6 % Pref. | 2 | 6 % | 3 % | 6 % | 1¼ — 1¾ | 1 — 1⅛ | .. | .. |
| 125,000£ | Do. do. 4½ % Perp. Deb. Stock | Stock | .. | .. | .. | 99 —102 | 99 —102 | .. | .. |
| 125,000£ | Do. do. 4½ % Perp. 2nd Deb. Stock | Stock | .. | .. | .. | 87 — 92 | 87 — 92 | .. | .. |
| 35,000 | Callender's Cable Construction shares | 5 | 15 % | 20 % | 15 % | 11¼ — 12½ | 11¼ — 12½ | 11⅜ | .. |
| 40,000 | Do. do. do. 5 % Cum. Pref. | 5 | .. | .. | .. | 5¼ — 5⅝ | 5¼ — 5⅝ | 5 5/16 | 5⅛ |
| 90,000£ | Do. do. do. 4½ % 1st Mort. Deb. Stock Red. | Stock | .. | .. | .. | 106 —110 | 106 —110 | .. | .. |
| 1,860,014 | Central London Railway, Ord. Stock | Stock | .. | 4 % | 4 % | 104 —107 | 103 —106 | 104⅜ | 103½ |
| 494,093 | Do. do. 4 % Pref. Stock | Stock | .. | 4 % | 4 % | 101 —104 | 101 —104 | 102½ | .. |
| 494,993 | Do. do. Def. do. | Stock | .. | 4 % | 4 % | 107 —110 | 107 —110 | .. | .. |
| 1,330,000 | City and South London Railway | Stock | 1½% | 2 % | 3½% | 63 — 65 | 63 — 65 xd | 64⅜ | 63 |
| 85,000 | Crompton & Co., Nos. 1 to 85,000 | 3 | 8 % | 7½% | .. | 2 — 2⅛ | 2 — 2⅛ | .. | .. |
| 100,000£ | Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 red. | .. | .. | .. | .. | 101 —105 | 101 —105 | .. | .. |
| 99,261 | Edison & Swan United Elec. Light, "A" shares, £3 paid, 1 to 99,261 | 5 | 2½% | Nil | .. | 0 — ¼ | 0 — ¼ | .. | .. |
| 17,139 | Do. do. "A" shares, 01—017,139 | 5 | 2½% | Nil | .. | 1⅛ — 2⅛ | 1⅛ — 2⅛ | .. | .. |
| 344,023£ | Do. do. 4 % Deb. Stock Red. | 100 | .. | .. | .. | 71 — 75 | 71 — 75 | .. | .. |
| 100,000£ | Do. do. 5 % 2nd Deb. Stock Prov. Certs. all pd. | 100 | .. | .. | .. | 75 — 80 | 75 — 80 | .. | .. |
| 112,100 | Electric Construction, 1 to 112,100 | 2 | 6 % | 6 % | 6 % | 1⅝ — 1⅞ xd | 1⅝ — 1⅞ | 1 9/16 | .. |
| 31,390 | Do. do. 7 % Cum. Pref., 1 to 31,390 | 2 | .. | .. | .. | 2⅛ — 3 xd | 2⅛ — 3 | .. | .. |
| 82,500£ | Do. do. 4 % Perp. 1st Mort. Deb. Stock | Stock | .. | .. | .. | 99 —102 xd | 99 —102 | .. | .. |
| 25,000 | General Electric Co. (1900), 5 % Cum. Pref. | 10 | 5 % | 5 % | 5 % | 9½ — 10 | 9½ — 10 | .. | .. |
| 200,000 | Do. do. 4 % Mort. Deb. | Stock | .. | .. | .. | 99 —102 | 99 —102 | .. | .. |
| 35,000 | Henley's (W. T.) Telegraph Works, Ord. | 5 | 20 % | 20 % | 20 % | 14 — 15 | 14 — 15 | 14¾ | .. |
| 35,000 | Do. do. 4½ % Pref. | 5 | 4½% | .. | .. | 5 — 5⅛ | 5 — 5⅛ | .. | .. |
| 48,050 | Do. do. 4½ Mort. Deb. Stock | Stock | .. | .. | .. | 108 —112 | 108 —112 | .. | .. |
| 50,000 | India-Rubber, Gutta-Percha & Telegraph Works | 10 | 10 % | 10 % | .. | 18⅛ — 19⅛ | 18⅛ — 19⅛ | 19⅛ | 18⅜ |
| 300,000£ | Do. do. do. 4 % 1st Mort. Deb. | 100 | .. | .. | .. | 100 —103 | 100 —103 | .. | .. |
| 37,500 | †Liverpool Overhead Railway, Ord. | 10 | 3½% | 1¾% | 1¾% | 5¼ — 5⅜ | 5¼ — 5⅜ | .. | .. |
| 10,000 | † Do. do. Pref. £10 paid | 10 | .. | .. | .. | 10½ — 11 | 10½ — 11 | .. | .. |
| 37,350 | Telegraph Construction and Maintenance | 12 | 17½% | 20 % | 20 % | 32 - 35 xd | 32 — 35 | 34⅞ | 34 |
| 150,000£ | Do. do. 4 % Deb. Bds., Nos. 1 to 1,500 Red. 1909 | 100 | .. | .. | .. | 100 —103 | 100 —103 | .. | .. |
| 540,000£ | Waterloo & City Railway, Ord. Stock | 100 | 3 % | 3 % | 3⅛% | 97 —100 | 97 —100 | .. | .. |

† Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. ¶ From Manchester Share List.

## LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

National Electric Free Wiring, ⅜—⅝.

Oldham, Ashton, and Hyde Electric (£10 pd.), Ord., 14¼—14⅝.
Do do. Pref. (£10 pd.), 10—10½.

**Bank rate of discount 3 per cent. (June 18, 1903).**

## SHARE LIST OF ELECTRICAL COMPANIES (*continued*).—ELECTRICITY SUPPLY COMPANIES.

| Present issue. | NAME. | Stock or Share. | Dividends for the last three years. 1900. | 1901. | 1902. | Closing Quotations July 22nd. | Closing Quotations July 29th. | Business done week ended July 29th, 1903. Highest. | Lowest. |
|---|---|---|---|---|---|---|---|---|---|
| | | ‡ | | | | | | | |
| 100,000 | Blackheath and Greenwich Dist. Electric Light, Ord... .. .. | 1 | .. | .. | .. | ⅝— ⅞ | ⅝— ⅞ | .. | .. |
| 100,000 | Do. 4½% 1st Deb. Stock, Prov. Certs. | 100 | .. | .. | .. | 118 —121 | 118 —121 | .. | .. |
| 20,000 | Brompton & Kensington Electric Light Sup., Ord., 1 to 20,000 .. | 5 | 6 % | 8 % | 8 % | 10½— 11 | 10½— 11 | 10⅝ | .. |
| 20,000 | Do. do. 7 % Cum. Pref. .. | 5 | .. | .. | .. | 10¼— 10⅜ | 10¼— 10⅜ | .. | .. |
| 50,000 | Charing Cross and Strand Electricity Supply .. .. .. | 5 | 9 % | 10 % | 10 % | 9 — 9⅛ | 9 — 9⅛ | 9⅛ | 9⅛ |
| 70,000 | Do. do. do. 4½% Cum. Pref. .. | 5 | .. | .. | .. | 5½— 6 | 5½— 6 | .. | .. |
| 40,000 | Do. do. "City Undertaking" 4½% Cum. Pref. .. | 5 | .. | .. | .. | 4½— 5 | 4½— 5 | .. | .. |
| 250,000 | Do. do. 4 % Deb. Stock Red. .. .. .. .. | 100 | .. | .. | .. | 104 —106 | 104 —106 | .. | .. |
| 44,436 | *Chelsea Electricity Supply, Ord. .. .. .. .. .. | 5 | 5½% | 4 % | 4½% | 5⅞— 6¼ | 5⅞— 6¼ | 6⅛ | .. |
| 150,000‡ | Do. do. % Deb. Stock Red. .. .. .. .. | Stock | .. | .. | .. | 107 —110 | 107 —110 | 108¾ | .. |
| 70,595 | City of London Electric Lighting, Ord. 40,001—110,595 .. | 10 | 0 % | 5 % | 5 % | 11 — 12½ xd | 11 — 11½ | 11⅜ | 11 |
| 40,000 | Do. 6 % Cum. Pref., 1 to 40,000 .. .. .. .. | 10 | 6 % | .. | .. | 13 — 14 xd | 13 — 14 | 13⅜ | 13⅛ |
| 400,000‡ | Do. 5 % Deb. Stock, Scrip. (iss. at 115) all paid .. | .. | .. | .. | .. | 121 —126 | 121 —126 | .. | .. |
| 800,000 | Do. 4½% 2nd Deb. Stock, Prov. Certs., all paid .. .. | 100 | .. | .. | .. | 102 —105 | 102 —105 | .. | .. |
| 40,000 | County of London & Brush Prov. Electric Lighting, Ord. 1—40,000.. | 10 | 4 % | 4 % | 4 % | 8 — 9 | 8 — 9 | .. | .. |
| 20,000 | Do. do. do. 6 % Pref., 40,001—60,000.. | 10 | .. | .. | .. | 11½— 12½ | 11½— 12½ | .. | .. |
| 400,000‡ | Do. do. 4½% Deb. Stock, Prov. Certs. (all paid) Red | .. | .. | .. | .. | 109 —112 | 109 —112 | .. | .. |
| 50,000 | Edmundson's Electric Corporation, Ord. Shares .. .. .. | 5 | 7 % | 7 % | 7 % | 6½— 7 | 6½— 6⅝xd | 7 | 6½ |
| 30,000 | Do. do. 6 % Cum. Pref. .. .. .. | .. | .. | .. | .. | 6 — 6½ | 6 — 6½ | 6⅝ | .. |
| 140,000 | Do. do. 4½% 1st Mort. Deb. Stock .. | 100 | .. | .. | .. | 106 —109 xd | 106 —109 | .. | .. |
| 21,000 | Kensington and Knightsbridge Electric, Ord. .. .. .. | 5 | 12 % | 10 % | 10 % | 11 — 12 | 10½— 11½xd | .. | .. |
| 90,000 | Do. do. do. 4 % Debenture Stock .. | Stock | .. | .. | .. | 103 —106 | 103 —106 | .. | .. |
| 110,000 | London Electric Supply Corporation, Limited, Ord. .. .. .. | 3 | .. | .. | .. | 2 — 2⅛ | 2 — 2⅛ | 2⅛ | 2⅛ |
| 49,840 | Do. do. do. 6 % Pref. .. .. .. | 5 | .. | .. | .. | 5⅜— 6 | 5⅜— 6 | .. | .. |
| 250,000‡ | Do. do. do. 4 % 1st Mort. Deb. Stock Red | Stock | .. | .. | .. | 100 —102 | 100 —102 | .. | .. |
| 100,000 | Metropolitan Electric Supply, 1 to 100,000 .. .. .. .. .. | 10 | 6 % | 6½% | 7½% | 17½— 18½ | 17½— 18½ | 18⅛ | 17⅝ |
| 220,000‡ | Do. do. 4½% 1st Mort. Deb. Stock .. .. | .. | .. | .. | .. | 108 —112 | 108 —112 | .. | .. |
| 250,000‡ | Do. do. 3½% Mort. Deb. Stock Red .. .. | Stock | .. | .. | .. | 97 —100 | 97 —100 | .. | .. |
| 10,852 | Notting Hill Electric Lighting .. .. .. .. .. .. | 10 | 7 % | 6 % | 6 % | 13 — 14 | 13 — 14 | .. | .. |
| 40,000 | St. James' and Pall Mall Electric Light, Ord. .. .. .. .. | 5 | 14½% | 14½% | 14½% | 15½— 16½ | 15 — 16 xd | .. | .. |
| 20,000 | Do. do. do. 7 % Pref. 20,081 to 40,080 | 5 | .. | .. | .. | 8½— 9½ | 8 — 9 xd | .. | .. |
| 150,000‡ | Do. do. do. 3½% Deb. Stock Red .. | 100 | .. | .. | .. | 98 —101 | 98 —101 | .. | .. |
| 12,000 | Smithfield Markets Electric Supply, Ord. .. .. .. .. .. | 5 | .. | .. | 2½% | 3 — 3½ | 3 — 3½ | 3⅞ | .. |
| 65,000 | South London Electricity Supply, Ord. .. .. .. .. .. | 5 | .. | .. | 1¾% | 3½— 4 | 3½— 4 | .. | .. |
| 80,000 | Urban Electric Supply, Ord. .. .. .. .. .. | 5 | .. | .. | .. | 5 — 5½ | 5 — 5½ | .. | .. |
| 80,000 | Do. do. 5 % Cum. Pref. .. .. .. .. | 5 | .. | .. | .. | 5 — 5¾ | 5 — 5¾ | 5⅞ | .. |
| 110,000 | Westminster Electric Supply, Ord. .. .. .. .. .. | 5 | 10½% | 10½% | 12 % | 12 — 13 | 12½— 13½xd | 13⅜ | 13 |
| 28,141 | Do. do. 5 % Cum. Pref. .. .. .. .. | 5 | .. | .. | .. | 6½— 6¾ | 6 — 6½ | .. | .. |

* Subject to Founders Shares. ‡ Unless otherwise stated all shares are fully paid.

## MARKET QUOTATIONS, Wednesday, July 29th.

| CHEMICALS, &c. | | Latest Price. | Week's Inc. or Dec. |
|---|---|---|---|
| *a* Acid, Hydrochloric .. .. | per cwt. | 5/- | .. |
| *a* ,, Nitric .. .. .. .. | per cwt. | 22/- | .. |
| *a* ,, Oxalic .. .. .. .. | per cwt. | 32/- | .. |
| *a* ,, Sulphuric .. .. .. | per cwt. | 5/6 | .. |
| *a* Ammoniac, Sal .. .. .. | per cwt. | 42/- | .. |
| *a* Ammonia, Muriate (crystal) .. | per ton | £33 10 | .. |
| *a* ,, ,, .. .. .. | per ton | £30 | .. |
| *a* Bleaching powder .. .. | per ton | £4 10 | .. |
| *a* Bisulphide of Carbon .. .. | per ton | £15 | .. |
| *a* Borax .. .. .. .. .. | per ton | £13 | .. |
| *a* Benzole (90 %) .. .. .. | per gal. | 7/- | .. |
| *a* ,, (50/90 %) .. .. .. | per gal. | 5/6 | .. |
| *a* Copper Sulphate .. .. .. | per ton | £19 | .. |
| *a* Lead, Nitrate .. .. .. | per ton | £24 | .. |
| *a* ,, White Sugar .. .. | per ton | £31 | .. |
| ,, Peroxide .. .. .. | per ton | £27 10 | .. |
| *a* Methylated Spirit .. .. .. | per gal. | 2/6 | .. |
| *a* Naphtha, Solvent (90% at 160° C). | per gal. | 5/6 | .. |
| *a* Potash, Bichromate, in casks .. | per lb. | 3d. | .. |
| *a* ,, Caustic (75/80%) .. | per ton | £24 | .. |
| *a* ,, Bisulphate .. .. | per ton | £35 | .. |
| *a* Shellac .. .. .. .. | per cwt. | 136/- | .. |
| *a* Sulphate of Magnesia .. .. | per ton | £4 10 | .. |
| *a* Sulphur, Sublimed Flowers .. | per ton | £6 5 | .. |
| *a* ,, Recovered .. .. | per ton | £5 10 | .. |
| *a* ,, Lump .. .. .. | per ton | £5 | .. |
| *a* Soda, Caustic (white 70 %) .. | per ton | £10 15 | .. |
| *a* ,, Crystals .. .. .. | per ton | £3 | .. |
| *a* ,, Bichromate, casks.. .. | per lb. | 2½d. | .. |

| METALS, &c. | | | |
|---|---|---|---|
| *b* Aluminium Ingots, in ton lots .. | per ton | £130 | .. |
| *b* ,, Wire, in ton lots .. | per ton | £168 | .. |
| *b* ,, Sheet, in ton lots .. | per ton | £166 | .. |
| *p* Babbitt's metal ingots .. .. | per ton | £43 to £145 | .. |
| *c* Brass (rolled metal 2" to 12") basis | per lb. | 6¾d. | ½d. dec. |
| *c* ,, Tube (brazed) .. .. | per lb. | 8¾d. | ½d. dec. |
| *c* ,, ,, (solid drawn).. .. | per lb. | 7½d. | .. |
| *c* ,, Wire, basis.. .. .. | per lb. | 7d. | ½d. dec. |
| *c* Copper Tubes (brazed) .. .. | per lb. | 9d. | .. |
| *c* ,, ,, (solid drawn) .. | per lb. | 9½d. | .. |
| *g* Copper Bars (best selected .. | per ton | £71 | .. |

| METALS, &c. (*continued*). | | | |
|---|---|---|---|
| *g* Copper Sheet .. .. .. | per ton | £71 | .. |
| *g* ,, Rod .. .. .. .. | per ton | £71 | .. |
| *e* ,, (Electrolytic) Bars .. | per ton | £64 | £1 dec. |
| *e* ,, ,, Sheets .. | per ton | £74 | £2 dec. |
| *e* ,, ,, Rod .. | per ton | £66 | £1 dec. |
| *e* ,, ,, H.C. Wire | per lb. | 7¾d. | ⅛d. dec. |
| *f* Ebonite Rod .. .. .. | per lb. | 3/8 | .. |
| *f* ,, Sheet .. .. .. | per lb. | 8/- | .. |
| *n* German Silver Wire .. .. | per lb. | 1/6 | .. |
| *h* Gutta-percha fine .. .. | per lb. | 8/- | .. |
| *h* India-rubber, Para fine .. .. | per lb. | 3/10½ to 4/0½ | dec. |
| *i* Iron, Charcoal Sheets .. .. | per ton | £18 | .. |
| *i* ,, Pig (Cleveland warrants) | per ton | 46/10½ | 2d. inc. |
| *i* ,, Forgings, according to size | per ton | From £11 | .. |
| *i* ,, Scrap, heavy .. .. | per ton | 47/6 to 50/- | .. |
| *i* ,, Wire, galvanised No. 8 .. | per ton | £9 15 | .. |
| *g* Lead, English Ingot .. .. | per ton | £11 12 6 | 2/6 dec. |
| *g* ,, ,, Sheet .. .. | per ton | £11 15 | 2½/- dec. |
| *m* Manganin Wire No. 28 .. .. | per lb. | 8/- | .. |
| *g* Mercury .. .. .. .. | per bot. | £8 12 6 | .. |
| *d* Mica (in original cases) small .. | per lb. | 4d. to 1/6 | inc. |
| *d* ,, ,, medium | per lb. | 2/6 to 3/9 | inc. |
| *d* ,, ,, large .. | per lb. | 4/- to 7/9 | inc. |
| *p* Phosphor Bronze, plain castings | per lb. | 1/- to 1/2½ | .. |
| *p* ,, rolled bars & rods | per lb. | 1/1 to 1/4 | .. |
| *p* ,, ,, strip & sheet | per lb. | From 1/2 | .. |
| *o* Platinum .. .. .. .. | per oz. | £4 | .. |
| *p* Silicium Bronze Wire .. .. | per lb. | 10d. to 1/- | .. |
| *i* Steel, Magnet, acc'd'g to desc'p'n | per ton | £58 | .. |
| *i* ,, ,, in bars .. .. | | £15 to £40 | .. |
| *g* Tin, Block .. .. .. .. | per ton | £128 to £129 | inc. |
| *g* ,, Foil .. .. .. .. | per lb. | 1/8 | .. |
| *n* ,, Wire, Nos. 1 to 16 .. .. | per lb. | 1/7 | .. |
| *p* White Anti-friction Metals— "White Ant" brand .. | per ton | £42 to £65 | .. |
| *j* Yarns, 2/10s Grey Cotton, on sp'ls | per lb. | 7½d. | .. |
| *j* ,, 6 lea. Flax .. .. | per lb. | 6⅝d. | .. |
| *j* ,, 3 ply 10 lbs. Russian .. | per lb. | 4½d. | .. |
| *j* ,, 10 lbs. Russian, single .. | per lb. | 4½d. | .. |
| *j* ,, 180 lbs. Jute rove .. | per ton | £11 | .. |
| *k* Zinc, Sh't (Vieille Montagne bnd.) | per ton | £23 15 | .. |

Quotations supplied by Messrs.:—*a* G. Boor & Co.; *b* The British Aluminium Co., Ltd.; *c* Thos. Bolton & Sons., Ltd.; *d* F. Wiggins & Sons.; *e* Frederick Smith & Co.; *f* India-Rubber, G.P. and Teleg. Works Co., Ltd.; *g* James & Shakspeare; *h* Edward Todd & Co.; *i* Bolling & Lowe; *j* W. H. Hindley & Co. *k* Morris Ashby, Ltd.; *m* W. T. Glover & Co., Ltd.; *n* P. Ormiston & Sons *o* Johnson, Matthey & Co., Ltd.; *p* The Phosphor Bronze Co., Ltd.

## ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RECEIPTS.

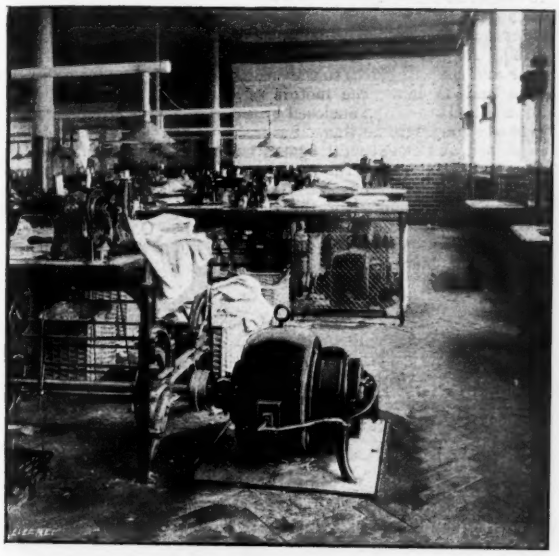
| | Locality. | Week ending | Receipts for the week. £ | £* | Total to date. £ | £* | Miles open. | * |
|---|---|---|---|---|---|---|---|---|
| | Aberdeen .. .. .. | July 25 | 1,625 | +512 | 10,440 | + 1,424 | 10 | — |
| | Birmingham .. .. | ,, 25 | 5,238 | +405 | 150,997 | + 7,038 | — | — |
| | Bournemouth .. .. | ,, 15 | 1,105 | — | — | — | 10½ | — |
| | Blackburn .. .. .. | June 26 | 909 | —286 | 11,668 | + 674 | 12½ | +1½ |
| | Blackpool .. .. .. | July 23 | 1,819 | +234 | 15,500 | + 1,323 | 8½ | — |
| | Blackpool and Fleetwood | ,, 25 | 1,391 | +182 | 3,836 | + 277 | 7½ | — |
| | Bolton .. .. .. | ,, 26 | 2,048 | +484 | 32,802 | + 4,627 | 25 | — |
| | Bradford .. .. .. | ,, 26 | 4,165 | +1030 | 64,240 | +10,267 | 39 | +2 |
| | Brighton .. .. .. | ,, 26 | 960 | + 91 | 68,387 | — | 6½ | — |
| | Bristol .. .. .. | ,, 24 | 5,581 | +860 | — | — | 28 | — |
| | Burnley .. .. .. | ,, 25 | 889 | +274 | — | — | 7½ | — |
| British Elec. Trac. Co. | Barnsley District .. | ,, 17 | 196 | — | 5,013 | — | 4½ | — |
| | Devonport .. .. | ,, 17 | 516 | + 5 | 12,173 | + 351 | 5 | — |
| | Dudley—Stourbridge.. | ,, 17 | 975 | + 77 | 22,588 | + 2,317 | 18½ | — |
| | Gateshead .. .. | ,, 17 | 891 | + 55 | 24,000 | + 4 042 | 10½ | + ½ |
| | Gravesend—Northfleet | ,, 17 | 281 | — | 6,217 | — | 3½ | — |
| | Greenock—Pt. Glasgow | ,, 17 | 584 | + 78 | 14,553 | + 1,329 | 7½ | — |
| | Hartlepool .. .. | ,, 17 | 296 | — 36 | 7,171 | + 410 | 6½ | +2 |
| | Kidderminster .. | ,, 17 | 190 | + 27 | 3,509 | + 212 | 4½ | — |
| | Merthyr .. .. .. | ,, 17 | 209 | — 4 | 5,501 | — 251 | 3 | — |
| | Middleton .. .. | ,, 17 | 191 | + 53 | 8,838 | + 883 | 8½ | — |
| | Oldham—Ashton .. | ,, 17 | 603 | — 1 | 15,991 | + 1,414 | 8 | — |
| | Peterborough .. .. | ,, 17 | 179 | — | 3,869 | — | — | — |
| | Poole .. .. .. | ,, 17 | 383 | + 40 | 7,935 | + 1,277 | 3½ | — |
| | Potteries .. .. | ,, 17 | 1 545 | + 56 | 43,617 | + 2,103 | 28½ | — |
| | Rothesay.. .. .. | ,, 17 | 261 | + 53 | 2,971 | + 1,028 | 2½ | — |
| | Sheerness .. .. | ,, 16 | 99 | — | 1,340 | — | 2½ | — |
| | Southport .. .. | ,, 17 | 380 | + 22 | 8,185 | + 1,707 | 5½ | — |

| | Locality. | Week ending | Receipts for the week. £ | £* | Total to date. £ | £* | Miles open. | * |
|---|---|---|---|---|---|---|---|---|
| B.E.T. Co. | South Staffordshire .. | July 17 | 1,006 | +177 | 23,703 | + 1,765 | 21½ | —½ |
| | Swansea .. .. .. | ,, 17 | 829 | +302 | 13,942 | + 926 | 5½ | — |
| | Taunton .. .. .. | ,, 17 | 65 | — 18 | 1,591 | — 137 | 1½ | +1½ |
| | Tynemouth .. .. | ,, 17 | 417 | — 41 | 8,102 | + 863 | 3½ | — |
| | Weston-super-Mare.. | ,, 15 | 290 | + 30 | 2,311 | — 263 | 2½ | +2½ |
| | Wolverhampton Dist. | ,, 17 | 420 | +144 | 10 881 | + 6,173 | 10½ | +8 |
| | Wrexham .. .. | ,, 17 | 134 | — | 2,150 | — | — | — |
| | Yorks. Woollen Dist.. | ,, 17 | 377 | — | 6,287 | — | 6 | — |
| | Cardiff .. .. .. | ,, 25 | 2,186 | +593 | 33,192 | +11,747 | 14 | — |
| | Chatham & District Co. | ,, 23 | 653 | +163 | 14,524 | +11,769 | 8½ | — |
| | Dover .. .. .. | ,, 18 | 265 | — 2 | 5,973 | + 123 | 3 | — |
| | Dublin .. .. .. | ,, 24 | 10,015 | +4889 | 23,061 | + 5,261 | 46 | — |
| | East Ham .. .. .. | ,, 25 | 700 | +249 | 11,455 | + 3,680 | 5 | + ½ |
| | Glasgow .. .. .. | ,, 25 | 11,471 | +2218 | 168,001 | +14,394 | 65 | +12 |
| | Hull .. .. .. | ,, 25 | 1,911 | +218 | 30,809 | + 1,950 | 11 | + 1 |
| | Ilkeston .. .. .. | ,, 22 | 192 | — | — | — | 4 | — |
| | Isle of Thanet .. .. | ,, 25 | 1,328 | + 61 | 15,548 | — 262 | 10½ | — |
| | Leeds .. .. .. | ,, 25 | 5,958 | +924 | 96,383 | + 6,627 | 41 | — |
| | Liverpool .. .. .. | ,, 18 | 10,700 | — 48 | 285,750 | +10,509 | 101 | +2½ |
| | Manchester .. .. | ,, 25 | 12,417 | +7062 | — | — | 110 | +85 |
| | Newcastle .. .. .. | ,, 25 | 3.510 | +638 | — | — | 17 | — |
| | Portsmouth .. .. | ,, 25 | 2,026 | +230 | — | — | 29 | — |
| | Salford .. .. .. | ,, 20 | 4,189 | +1488 | 59,417 | +18,291 | 30 | — |
| | Southampton .. .. | ,, 23 | 1,115 | +119 | — | — | 9 | — |
| | Sunderland .. .. | ,, 27 | 1,426 | +222 | 20,631 | + 669 | 18 | +1½ |
| | Central London Railway | ,, 25 | 6,402 | +184 | 26,662 | + 71 | 6 | — |
| | City and S. London Ry. | ,, 26 | 2,545 | —170 | 9,963 | — 928 | 6½ | — |
| | Dublin and Lucan Rlwy. | ,, 26 | 197 | + 74 | 542 | + 47 | 7½ | — |
| | Liverpool Overhead Ry. | ,, 26 | 1,710 | +149 | 6,842 | + 469 | 6½ | — |

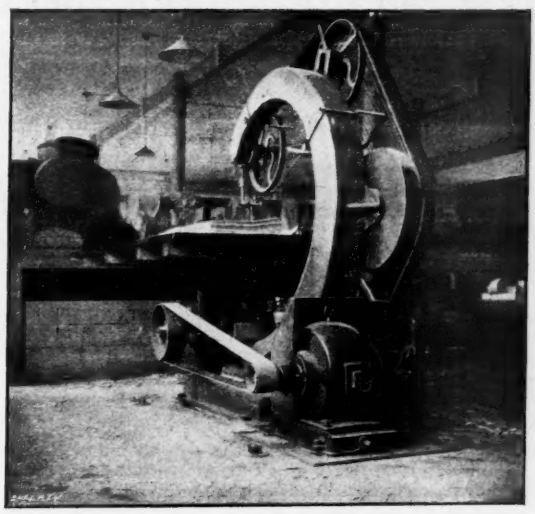
* Compared with the corresponding period of 1902.

## AN ELECTRICALLY-EQUIPPED FACTORY IN BERMONDSEY.

The many advantages of electricity in factories are rapidly becoming recognised in this country, and instances where all the plant in manufacturing establishments is operated electrically are increasing daily. It is not often, however, that in the building of a new factory the proprietors adopt the wise and far seeing plan of appointing an engineer at the outset to advise upon the arrangement of the whole of the plant, and in conjunction with the architect, plan out the building so far as possible to suit all requirements. It more generally happens that an independent engineer is called in at the last moment, when the arrangement of the machinery has been settled and the building nearly completed, and in this way many economies which might have been obtained in capital expenditure, and costs of working, are rendered impossible, and the engineer has to do the best he can under difficult circumstances.



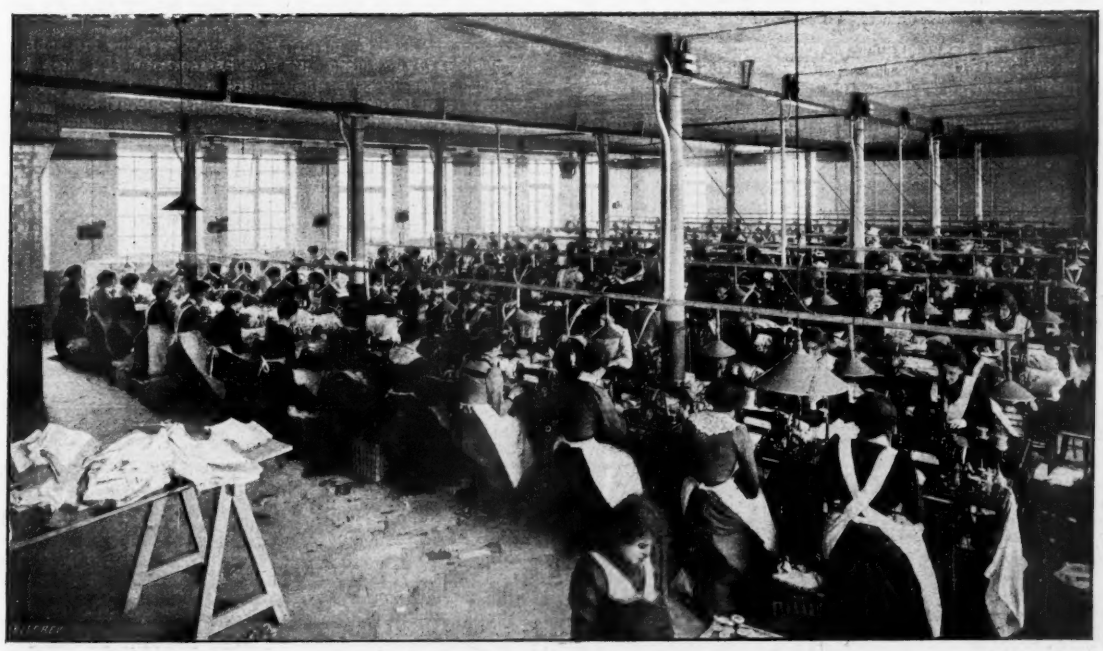
Arrangement of Motors in Machine Room.



Electrically-driven Cloth Cutter.

The advantage of such foresight is well illustrated in the case of Messrs. Young & Rochester's new shirt factory at Bermondsey. The architect for the building is Mr. W. T. Walker, of 40, Finsbury Square, London, E.C., and the consulting engineer for the whole of the engineering equipment is Mr. Walter P. Adams, of 35, Queen Victoria Street, London, E.C.

The extensive brick buildings occupy the greater part of a large square space, entirely surrounded by dwelling houses with their small gardens backing on to the area. This unusual position rendered it necessary that the power generating plant should be noiseless, smokeless and free from vibration. These considerations, and the fact that steam had to be provided for the laundry, kitchen, and drying rooms, and for heating the building, led to the adoption of steam power. The engine and boiler houses and coal bunkers are at a lower level than the rest of the building, thus facilitating the handling of the fuel. The boiler plant consists of a Davey-Paxman "Economic" boiler, 7 ft. 6 in. in diameter, and capable of evaporating 4,000 lbs. of steam per hour; a small Green economiser, with scrubbers driven by an electric motor; a Weir compound feed pump, a Kennedy water meter and injectors. The steam pipes to the engine are in duplicate; the feed water pipes are also in duplicate, and are so arranged that hot or cold feed can be supplied by either feed pump or injectors, and all water has to pass through the meter. In the economiser room is a large galvanised iron storage tank, in addition to one on the roof, and all water used in the building either for steam generation or laundry purposes is effectively softened by a Stanhope Engineering Co.'s water-softening plant on the top floor.

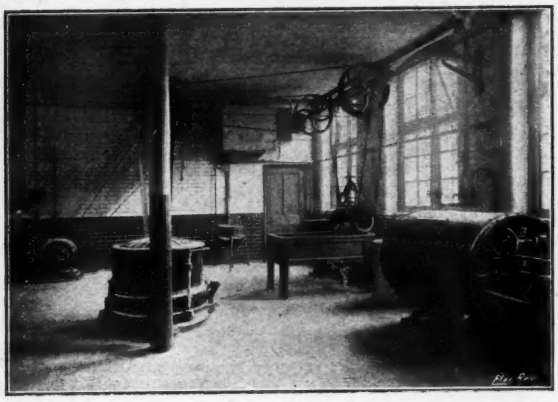


Machine Room: 130 Sewing Machines, Driven by Five 2-h.p. Motors.

Careful consideration was given to providing smokeless plant, and the merits of oil fuel and other special means were well weighed before it was decided to adopt Messrs. Meldrum Bros.' steam forced draught furnaces for burning coke breeze, which at the then price of breeze showed a saving of some 30 per cent. over a coal-fired furnace; since the plant was installed, however, the gas companies in the neighbourhood have seen fit to increase the price of breeze considerably, so that the saving is now much less—wicked gas com-

panies! However, the chimney stack at Electra Factory probably holds the record for all London, in that since the completion of the works about a year ago, smoke has never issued from it to befog the already dingy neighbourhood of Spa Road, or to blacken the neighbours' linen, which is plentifully displayed nearly all the week round in the little back gardens.

Air is conveyed to the front of the boilers through ducts under the floor, which are connected to the outside of the building through



Laundry Machinery, Driven by 6-h.p. Motor.

stout iron casings. The pipes for this purpose are plainly seen in the illustration on this page. This arrangement has been adopted to prevent undue noise from the blast.

The engine room is large enough to accommodate two 60-kw. generating sets, only one of which has been installed at present. This is a Johnson & Phillips multipolar dynamo, coupled direct to a Reaveil high speed enclosed compound engine, running at 500 revolutions per minute. The dynamo is compound-wound to give 200 volts at no load and 220 volts at full load. The governing of the engine is excellent; with full load suddenly removed the speed rose temporarily from 500 to 525 revolutions, and very promptly settled at 506, and even better results were obtained on switching on full load. At no load the speed was 500 revolutions; with load switched on, the momentary drop was to 488 revolutions, and the speed settled quickly to 497. The extreme momentary variation was thus 5 per cent., and the permanent alteration about 1 per cent. with full load put on and off.

The switchboard is arranged for two generating sets, and is provided with two Kelvin & White recording wattmeters, one for the power circuits and one for lighting; these have furnished some most interesting diagrams of the demand.

Separate mains for both lighting and power are run from the switchboard to distribution boards on each floor. The mains are concentric lead-covered paper-insulated cables, and the whole of the wiring is done with twin lead-covered wires run on the surface.

The bulk of the lighting is by incandescent lamps, but some six Nernst lamps have been installed, and have given much satisfaction. The laundry and the large space outside are arranged for inverted arc lamps. Altogether, lamps equivalent to 600 8-c.p. glow lamps have been fixed.

On the ground floor are arranged the stock and packing departments, where no machinery is used. The first floor is devoted to the cutting department and the laundry and drying rooms. In the cutting department an electrically-driven cutting machine is in use, and in the laundry all the machinery is compactly arranged, so that one 6-h.p. motor may be used to drive it through a short length of shafting. An ironing room adjoins the laundry, and is fitted for 16 electrical flat-irons.

The machine room is on the second floor, and is arranged for eight rows of 26 sewing machines each, of which five rows are already fitted. At the end of every bench a 2-h.p. motor is fixed to the floor and coupled direct to the shafting running under the bench from end to end. The motors run at about 400 revolutions per minute, and are of the enclosed type; each motor is protected by a cage of strong wire netting. Several types of sewing machines are employed, and some useful figures have been obtained of the power absorbed by measuring the current taken by the different motors. Each motor is provided with a starting switch and resistance with no-load release, and when the generating plant is shut down the motors are automatically cut out of circuit. On the same floor as the machine room is the giving-out room, where six electric flat irons are in use. All the irons employed in the building are electrically heated.

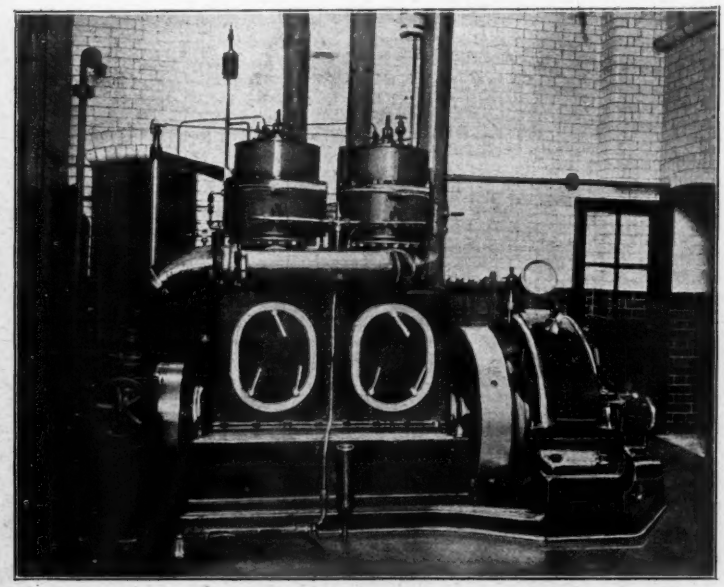
The top floor forms a spacious dining-room, where the hands are privileged to obtain their meals at nominal prices. Large and very complete kitchens, with steam and gas-heated apparatus, adjoin the dining room. Messrs. Young & Rochester are well known for the kindly interest they take in the welfare of their employés.

An electric lift, fitted with a 6-h.p. motor, serves all floors, and an electric jib crane is used for unloading vans in the yard.

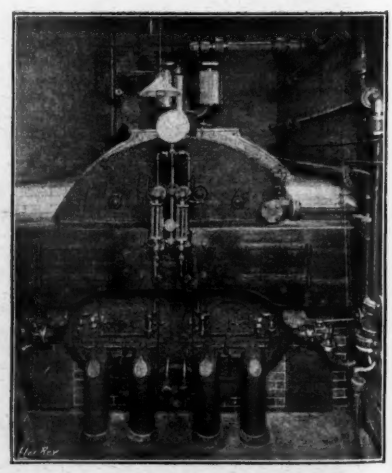
The heating of the building is by steam, the exhaust from the engine being used; the cooking is also done with exhaust steam. The condensed steam, from both radiators and kitchen, is collected in a tank outside the boiler house, and this water is lifted to the tank in the economiser room by means of an electrically-driven centrifugal pump. A float, connected by wire cord through a pulley to a throw-over switch, causes the pump to start automatically when the tank is full, and to stop when emptied; the whole apparatus acts admirably.

The ventilation of the building has received careful consideration, and is carried out effectively by means of a large galvanised iron trunk rising from the bottom to the top of the building. On each floor gratings are provided which can be opened and closed at will, and at the top of the trunk is an electrically-driven fan discharging above the roof.

It will be seen that full advantage has been taken of the facility with which electricity lends itself to the economical distribution of power as well as lighting and heating. Besides the cleanliness, simplicity, and safety of electric power, the economy is marked, and a better illustration could not be furnished than by comparing the costs of fuel and lighting in the new factory with the costs at Messrs. Young & Rochester's factory at Londonderry, erected just 10 years ago. The factories are about the same size, and, comparing the costs on the same basis, it is found that the coal consumption at the Derry factory is nearly double that at Electra Factory, and the cost of lighting by gas is four times as great. The saving in fuel cost is not the only economy effected; the cost of repairs to shafting and belting, the oil consumption and other incidental expenses are also greatly reduced. Such figures as these ought to convince English manufacturers that electricity is a force to be reckoned with in these days of keen competition.



Reavell-Johnson & Phillips Steam Dynamo.



"Economic" Boiler, with Meldrum Forced Draught Furnaces.

# THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

## THE SPHERE OF UTILITY OF A POWER COMPANY.

By Alderman G. Pearson (Hon. Solicitor), Chairman of the Bristol Electrical Committee.

The author commences by recognising the fact that power companies have come to stay, and proceeds to consider how they can be utilised by municipalities. He gives a list of the Acts already obtained by companies, pointing out the names of towns excluded from their operations, and is uneasy about the fate of his own town (Bristol), which a Committee of the House of Lords has included in the Somerset and District Power Bill. He also gives a statement of the prices and dividends provided for in the Acts, but as these are the maximum limits of charge, they do not convey much practical information to the authorised distributors of energy supplied in bulk, which is, of course, charged for below the highest rates named in the Acts.

The rates actually charged by five of the companies now in operation are of more interest, and the author claims that the municipalities are supplying energy for power and light at a much cheaper rate than the average company, but appears to qualify this statement by the remark that "he sees no reason why, when municipal power loads grow, they may not supply current for power purposes cheaper than a power company."

The author's idea of the proper function of a sliding scale is "to induce company directors to secure an economical and efficient management, whereby the consumer obtains the article he requires at the cheapest possible rate, and the shareholders of the company participate in the economies by receiving an increased dividend as the price of the article is reduced; but," he adds, "if you wish to avoid responsibilities and still secure increased dividends, you have only to fix your standard price sufficiently high to secure expensive and inefficient management and still high dividends to the shareholders."

The author explains this curious position by reference to the financial proposals in the Somerset and District Electric Power Bill, which provide for dividing the shares into "preferred half shares" and "deferred half shares"—thus securing the benefit of preference shares, to the serious injury of the customers of the company. He also assumes that prices are involved in dividends; but the fact is, that the value of the article is what it will fetch, and if too much is charged it will not be purchased; the consumer protects himself by buying only on terms that suit him—whatever dividends are in question—and Mr. Alderman Pearson may not be far out when he says, "Parliament, in its wisdom, or otherwise, has reduced the sliding scale system to the point of absurdity."

The author makes a similar statement to that in the President's address, as to the cost of plant, charges for energy, and costs of production, as between corporations and companies, quoting from the *Electrical Engineer*, and gives as his reasons for this that corporations get cash terms, are not tied to manufacturers, have no watered capital, and with better credit are able to raise money cheaper than companies.

The alderman winds up by pointing out the advantages of a power company in supplying groups of small towns in bulk, the distribution being left to the local authorities, and does not disguise the fact that he approaches the consideration of the question from the municipal side, hoping to find some common ground of agreement between power companies and municipalities, whereby they may be enabled to avoid competition which may become injurious to municipalities and ruinous to companies.

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Mr. A. B. Mountain, in opening the discussion, agreed with the views expressed by the author. He did not see how power companies could supply electricity as cheaply as Corporations. In view of the necessarily large expenditure on the part of a power company on distributing plant, where small towns were concerned, he considered that a local company would have the advantage.

Mr. Portheim referred to the low capital cost of some Continental power schemes, which he attributed to the adoption of overhead transmission. Instead of costing £6,000 per mile, it might be only £600.

Gen. Webber agreed with the last speaker that this was the crux of the matter. He considered that great difficulties would be experienced owing to the enormous number of landowners who would be affected, and the necessity for avoiding roads. He thought a great deal depended on Parliamentary powers being obtained for overhead lines.

Councillor Wall, Birkenhead, favoured Corporation supply as being more economical.

Mr. Steinitz urged that Corporations should let the power companies supply in their areas; they only asked for permissive powers. He contended that some companies were supplying cheaper at the present time than any Corporation. The Newcastle-on-Tyne Electric Supply Co. received an average of only 1·85d. per unit, and the County of Durham Power Co. only obtained 1·43d. per unit.

Mr. R. A. Chattock voiced the objections of municipalities to having their streets disturbed by outsiders. From the prices charged by the power companies, he did not think there would be any great object in allowing the latter to supply within municipal areas.

Mr. Robt. Hammond said that Parliament had encouraged the municipalities to expend large sums on their undertakings on the understanding that they would have a safe thing, and it would, therefore, be grossly unfair to allow competition of this nature. The Corporations were bound by the terms of their prov. orders, while the companies were free lances, who could offer discriminating rates. There was no case of competition outside London, the Newcastle companies having agreed to divide the area of supply.

Mr. W. L. Madgen testified to the low average charges of the Gateshead and North Metropolitan Companies, the latter having large contracts at from 1d. to 1·4d. per unit. He reaffirmed the fallacy of comparing figures in regard to companies and Corporations, pointed out several cases of metropolitan boroughs which had not been too successful. He had been very much interested in Mr. Hammond's "monopoly speech."

Mr. Robert Quin considered that the author of the paper had been unduly influenced by his recent occupation in connection with the Somerset Bill, and was not fair to the power companies. He referred to the injustice of comparing London companies with provincial corporations in the matter of capital expenditure. The provincial municipalities controlled all the best supply areas, and it would be discreditable if they did not come out better than small local companies. He had no objection to permissive supply on the part of companies by mutual agreement, but advocated the combination of neighbouring towns as preferable to power companies.

Mr. J. E. Edgcome agreed that municipalities had been misled by Parliament. There was no reason why both parties should not work together each in its own sphere.

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## OBSERVATIONS ON ELECTRICITY SUPPLY AND METHODS OF STIMULATING DEMAND.

By Councillor J. E. Panton, M.D., Chairman of the Bolton Electricity Committee.

Dr. Panton contributed a paper on this subject which is of interest to all engaged in the business. He opens with a reminiscence of the lighting of the Thames Embankment by the old Jablochkoff candle, and the Edison experiments on the Holborn Viaduct, when electric lighting was an expensive luxury, the charge being 10d. to 1s. per unit for energy and 5s. each for the incandescent lamps. He refers to the company boom in 1882, the reaction which followed, and the turn of the tide in 1886, with its growth to the present day, when the industry is represented by a capital of 45 millions sterling. He advocates low prices as the means of materially increasing demand, and thinks that, notwithstanding all the indirect economies due to cleanliness, convenience, healthiness, absence of noxious fumes, &c., the cost must be as low per candle-power-hour as that of any other illuminant.

Similarly with motive power, he does not look for great progress until it is cheaper to drive by electricity than by any other means, and the continuity and reliability of the supply are assured.

The author discusses the importance of a good load factor, and points out the advantage of combining the lighting and power supply. With such a load factor, and one set of mains serving both purposes, he predicts that the selling price will be about 1d. per unit for power and 3d. for lighting or an average all-round price of 1·5d., and he doubts if anyone will dispute the feasibility of producing and distributing below that figure so as to allow a handsome margin of profit. He adds that he includes in the cost, interest and depreciation, the latter item including such sums as may be required annually to repay the loans in the prescribed period of years.

He illustrates by curves the overlapping of the motor and lighting loads, and recommends the encouragement of a day load at anything above works cost.

Dr. Panton advocates the system of hiring out the motors and gives the clause in the Bolton Parliamentary Bill of 1901, under which that Corporation obtained powers to do so. He states that in Bolton, the cost of the motor and fixing with starting switch being ascertained, 10 per cent. per annum on the capital cost is charged as rental. He mentions that the cost of upkeep for hired motors in Bolton was:—For the year ended March 31st, 1902, £2 13s.; rental, £108; and for the following year, £20 10s. 11½d; rental, £235. He recommends canvassing and instructs canvassers in their business. He also advocates electrical exhibitions, lectures on motor driving, and the cultivation of supply to chemical works.

The author refers to the so-called free-wiring system, and would prefer "assisted wiring," the Corporation putting it in and charging 9 per cent. per quarter as rental, with landlord's guarantee. At the end of three years the rentals having been duly paid represent the total cost of the installation plus 8 per cent., which percentage the Corporation would retain to cover interest on capital outlay and any slight cost entailed in collecting the amount by instalments; the installation would then become the property of the hirer.

Then follows a sort of Cheap Jack proposal, viz., "If, however, 9 per cent. per quarter pressed too hardly on the small consumer, 8, 6 or 5 per cent. might be charged as a rental for a proportionately longer period."

He advocates the abolition of meter rents, street lighting at a very low price, and tramway traction at somewhat higher figures than for motor supply, because the latter gradually tails off from five to six o'clock each evening, when the lighting load comes on. He would cater for charging storage batteries for motor-cars. He attacks the maximum demand system of charge, while admitting that it is theoretically unassailable, and instances church and chapel lighting, where it operates against a supply on Sundays, when shops and business premises are shut up. Then again, in assembly rooms the load rarely comes on during the peak, but in the "Wee sma' hours."

The author doubts whether the capital cost of installing demand indicators and taking the records is not more than the benefits obtained, especially with small consumers. He recommends flat rates of 3½d. to 4d. per unit for lighting, with special terms for special classes of consumers. He considers that supply authorities have done too much to discourage the short-hour consumer, and strongly opposes the maximum demand system for motive power supply.

In Bolton he states that the charge is 2½d. per unit up to 500 units a quarter, less 10 per cent. for payment within 21 days, then 1½d. for the second 500 units per quarter, and beyond this quantity 1d. net.

The alderman concludes his paper by asserting that "Consumers do not, as a class, understand the maximum demand principle of charging, and if it be explained to them with great care their intelligence seems to break down, although they may be in every other respect capable business men!" This want of understanding, he adds, engenders distrust, which is one of the greatest factors in materially retarding demand.

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Bailie McKenzie, Edinburgh, who opened the discussion, condemned the "Bermondsey clause," and heartily supported the proposals as to decreased prices, and as to offering specially cheap rates to bulk customers. He also emphasised the benefits of street lighting.

Bailie Willock, Glasgow, said that committees do not appreciate the true value of day loads, and concluded by urging his hearers not to lose a customer.

Mr. Griffin, Swindon, appeared to have suffered from the competition of the local gas company, who were fitting up houses free—a fact which had led the Corporation to consider the obtaining of powers for similar work in connection with electrical consumers.

Mr. Maxwell, Partick, considered that a street lighting load was better than a traction load, and that the prices charged for the former were much too high.

Mr. A. B. Mountain, Huddersfield, mentioned having supplied energy to a carbide plant at ½d. per unit, between the peak loads. He considered that no charge for power should be above 1d. per unit, and that the gas interests received too much protection.

Mr. Hoadley, Maidstone, had supplied energy for a 60-h.p. motor at 1d. per unit, and he calculated it cost him 3d. in fuel and oil to produce. In the matter of cheap wiring, he had looped up batches of eight small houses in Barking, and the consumers' bills came to 8d. per week, as compared with 1s. 2d. for oil.

Mr. J. Christie, Brighton, had supplied energy for motors at 1d. per unit—in the intervals between the peak loads. They used a time-switch to disconnect customers, and found that the latter suited their hours of business to the supply.

Mr. J. E. Edgcome, Kingston-on-Thames, spoke on free wiring, and Dr. Panton, in briefly replying, mentioned, in regard to the charge for street lighting, that there were only four public arc lamps in the borough, the Gas Committee having control of the street lighting.

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## THE FINANCIAL IMPROVEMENT OF ELECTRICITY SUPPLY WORKS.

By J. A. Jeckell, Borough Electrical Engineer, Coventry.

This is a paper written, as the author states at the commencement, more particularly for the commercial element in connection with electrical supply undertakings. This affects the chairmen of committees probably to a greater degree than the engineer, although it is, or should be, due to the latter's initiative that any proposal is brought forward. After remarking on the early difficulties in the way of giving a reliable supply, the author states "that enterprises in England are judged by their commercial success rather than by the engineering achievement." This is no doubt true as a generalism, but in view of the keen criticism which electrical undertakings undergo at the present time, it can hardly be doubted that in their case successful engineering and commercial prosperity to a great extent march hand-in-hand.

The author then goes on to discuss the demand for cheap power, which he considers exists among large manufacturers, and in a far greater degree among their brethren in a smaller way of business.

"The large manufacturers can fairly easily put down power stations for themselves and generate their own energy, though even they seem often to prefer purchasing it when it is supplied at a low rate."

The tendency of manufacturers to establish works in the provinces rather than in populous centres, is held out as a bait to the local authorities to establish cheap power supplies.

The author proceeds:—"It is well known that many of the power Bills were thrown out when it was clearly proved that the local authority in the area the company proposed to supply in was not only able and willing, but was actually supplying power at a rate lower than the company promised or was then doing. For instance, before the Committee, of which Sir James Kitson was chairman, the South Shields Corporation, when a power company proposed to come in and supply power in their area, were able to prove that they were manufacturing current at 28 per cent. less and selling it at less than 19 per cent. less than the company was. Again, in the case of the Leicestershire and Warwickshire Power Bill, the company proposed to come in and supply energy in Coventry. The price at which the company proposed to sell energy was 3d. per unit for the first 400 hours per quarter, and 2d. afterwards. The price at which the Coventry Corporation were *then* selling current, was 6d. for the first 91 hours in the quarter, 3d. for the second, and 1d. for all the remainder. Energy for power, heating and cooking was being supplied at 1¾d. per unit, all round, *i.e.*, a consumer using energy for eight hours a day under the company would pay 2½d. per unit; under the local authority, 1¾d. per unit; or, if on the lighting tariff, 1·87d. per unit," and that it is easy to design an entirely new station for power supply now; but a far "more difficult problem to adapt and extend existing stations, so that electricity may be made cheaply enough to be sold at a low price, and an enhanced profit made," &c. "This is the problem which nearly all managers will have to face in the very near future." Mr. Jeckell is evidently looking at the problem from the Coventry (and, perhaps, we may add, South Shields) point of view—in both these cases, a single-phase alternating supply existed, which, it is well known, has not proved successful with power users—but as a great majority of power stations are supplying continuous current, and, in many cases, to a rapidly increasing circle of power users, it is not easy to appreciate the force of these remarks. This does not, of course, refer to stations savouring of the antique, of which Coventry appears to have been one.

The writer refers to the well-known peculiarity of committees, in that they will agree to a policy proposed by a new manager, although, had his predecessor suggested a similar thing, they would not have supported it, and for this reason the "new broom" is often able to make a clean sweep of many ancient traditions, which have so seriously hampered his predecessor. The writer then discusses the price at which energy can be made and sold.

Referring to the argument used in the early lighting days, when load factors were small, that it paid better to save capital and put in less expensive plant, which was not so efficient, rather than to put in the most efficient plant at an increased capital cost, the author rightly concludes that, with increased day loads, the saving in financial charges will quickly be overshadowed by the growing fuel costs, and stations built on this principle would naturally be uneconomical; but as they are very, very rare—in fact, curios—the reference and succeeding figures lose their significance.

Taking a hypothetical case, assuming 100-kw. plant running 12 hours a day for 300 days in a year.

A set takes 25 lbs. of steam per unit.
B set takes 35 lbs. of steam per unit.

Say coal costs 7s. 6d. per ton and evaporates 5 lbs. of water per lb. of coal, therefore,

$$\frac{\text{kw.} \quad \text{hrs.} \quad \text{days.} \quad \text{lbs.} \quad \text{shillings.}}{1{,}000 \times 12 \times 300 \times 2 \times 7{\cdot}5} = £1{,}200.$$
$$2{,}240 \times 20$$

Therefore B plant costs £1,200 per annum more to run than A, or capitalised at 6 per cent. £20,000, *i.e.*, this amount extra could have been paid for A plant, and still it would have cost no more than B to run.

Or, where coal is dearer, take best Welsh costing 30s. a ton, and this evaporates 10 lbs. of water per lb. of coal.

$$\frac{\text{kw.} \quad \text{hrs.} \quad \text{days.} \quad \text{price.}}{1{,}000 \times 12 \times 300 \quad £1{\cdot}5} = £2{,}410.$$
$$2{,}240$$

Therefore B plant costs £2,410 per annum more to run than A, or capitalised at 6 per cent. £40,000.

From this the author concludes that it pays to use the most efficient plant, even more where coal is dear, than where it is cheap. A point which will require consideration is the type of engine, steam consumption, floor space, attendance and stores being determining factors.

The author emphasises the necessity of taking the average steam consumption. He does not think that large high-speed engines have much advantage over the low-speed types in the matter of floor space, with the exception of turbines. He considers the policy of cutting down wages and stores to be questionable in view of the fact that the plant has to be kept in thoroughly good working order out of revenue.

From the preceding figures the author relegates capital cost of plant to the background. This, however, should surely be qualified, as the advent of the turbine has enabled radical savings to be made in cost of buildings without sacrificing efficiency.

The next point the author considers is what *extra* capital above that already spent will be necessary to provide the plant required to supply power, also what *extra* cost there will be in total station charges.

"It is very necessary to consider only the *extra* cost both for capital charges and station costs, because the already existing capital charges and station costs will have to be met whether the power supply is given or not. To clearly demonstrate this we will take the following example:—

"A station with the following accounts:—Capital, £75,000; total plant capacity, 600 kw., earning capacity 400 kw., sells 400,000 units per annum.

| | | |
|---|---|---|
| Station costs at 2d. per unit .. ... ... | | £3,333 |
| Capital charges at 5½ per cent. ... ... | | 4,125 |
| | | 7,458 |
| Revenue 400,000 units at 4d. ... ... ... | | 6,666 |
| Loss ... ... ... | | £792 |

"A demand occurs for power at 1½d. per unit, probable amount 1,000,000 units. The question is, can this amount be supplied at this price and a profit made?

"One manager will say 'No, because my costs are 2d. per unit now

without capital charges.' Another manager works it out like this:—

| | |
|---|---|
| Extra capital required, £30,000 | |
| Extra capital charges at 5½ per cent.... ... | £1,650 |
| Extra station charges ... ... ... ... | 2,000 |
| Total extra cost ... ... ... ... ... | £3,650 |
| Extra revenue at 1½d. on 1,000,000 units ... | £6,250 |
| Less cost ... ... ... ... ... ... | 3,650 |
| Profit on transaction ... ... ... ... | £2,600 |
| Less loss on lighting ... ... ... ... | 792 |
| Profit on station... ... ... ... ... | £1,808 |

The second manager naturally closes with the offer at once, and turns the loss on his station into a profit. It will be seen at once from this how very profitable it is to supply power from an existing station."

Evidently from the foregoing Mr. Jeckell has a very poor opinion of his brothers in the craft. For our part we cannot imagine a manager who would summarily reject a proffered additional 1,000,000 units at 1½d. each for power purposes (*i.e.*, day load) on to their existing output of 400,000 lighting units if there was a possibility of obtaining the necessary generating plant to cope with it. If his remarks had referred to the committee, well, perhaps the less said the better.

Mr. Jeckell then cites the case of his own town of Coventry, in which, when he took over the helm, the plant and business methods could only be described as archaic. The system was single-phase, rope-driven alternators and horizontal engines. The town is exceedingly scattered, and the use of gas engines is established for factory driving. The station costs amounted to 3d. per unit for the year ending 1901. Capital charges were 2·66d, making a total cost of 5¾d., and as the average price obtained was 4·14d., a loss of 1½d. was incurred on every unit sold.

The author quickly decided that it would be unwise to raise the price, and the only course open was therefore to reduce the cost of manufacture and to popularise and extend the use of electrical energy. He decided that he could treble the earning capacity of the plant if the capital of the undertaking were doubled.

The author notes that in April last year £27,893 had been spent on mains and 27,226 lamps connected. During the past year £5,185 additional was spent on mains, and to these have been connected 10,266 lamps. So that the cost of mains per lamp connection on the extension was less than half that in the case of the old mains, from which the author considers it advantageous to extend mains widely. It is no doubt correct that the first cost of a mains network, including as it does a large proportion of feeders, is heavier per lamp connection than the subsequent distribution extensions, but in the case of Coventry, Mr. Jeckell's predecessor spent a considerable time in re-organising the distributing network, which is no doubt benefitting the department at the present time.

It was decided to adopt two-phase generators and supply the outlying sub-stations on that system—the centre of the town being supplied for the present with the existing plant.

In the matter of motors, the author supplied single-phase motors up to 16 H.P. (prior to getting the two-phase plant running), and he says "we found no difficulty whatever in running these motors off the lighting circuits, provided ordinary engineering precautions were adopted."

Since the two-phase system was started some 350 H.P. of motors have been connected.

"By bringing about certain economies at the works, the actual cost for station charges has been brought down to the same figure as for 1901. In fact, it will be seen that, even including the capital charges, the actual cost of manufacturing current this year was the same as in the year 1901, though he sold this year 566,000 units, as compared with 341,000 units in 1901 Or, to put the accounts in the form given in the previous hypothetical case—

BEFORE EXTENSIONS WERE CARRIED OUT, 1901.

| | |
|---|---|
| Capital spent, £78,513. | |
| Station costs ... ... ... ... ... | £4,358 |
| Capital charges ... ... ... ... ... | 3,789 |
| Total costs ... ... ... ... ... | £8,147 |
| Total revenue ... ... ... ... ... | 5,897 |
| Loss ... ... ... | £2,250 |

AFTER EXTENSIONS HAVE BEEN PARTLY CARRIED OUT, 1903.

| | |
|---|---|
| Capital spent, £102,712. | |
| Station costs ... ... ... ... ... | £3,573 |
| Capital charges ... ... ... ... ... | 4,574 |
| Total costs ... ... ... ... ... | £8,147 |
| Total revenue ... ... ... ... ... | 7,958 |
| Loss ... ... ... | £189 |

N.B.—It should be remembered, in comparing these figures, that, as before mentioned, the coal cost some £500 more in 1901 than it would have done in normal years, owing to the greatly enhanced prices."

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The discussion on the paper was opened by Mr. ROBT. HAMMOND, who plumped for an extensive mains network at the commencement of supply. He mentioned the case of Hackney, where they had spent £120,000 on mains before opening, and had in 15 months exceeded his estimate of connections for three years. He hoped that chairmen would take this to heart and double their mains, besides reducing their prices.

Mr. GERALD STONEY did not care for the maximum demand system, which was too complicated.

Mr. TURNBULL (Tynemouth) suggested that separate plant should be installed for dealing with the peak load, and went on to suggest some possible development of his old favourite, the locomotive.

Mr. RUTHVEN MURRAY (Willesden) believed in the maximum demand system, properly applied, and suggested 8d. per unit for the first hour and 1d. after as a basis of charging. He mentioned the necessity for plainly marking indicators, so that consumers could obtain the required information at a glance.

Mr. JECKELL briefly replied.

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BUSINESS MEETING.

At the annual general business meeting of the Association held on Saturday, the 18th inst, at Sunderland, the election of officers for the ensuing year took place, Mr. T. P. Wilmshurst being elected President, and the town of Derby being provisionally selected as the location of the 1904 Convention. Messrs. F. A. Newington (Edinburgh) and R. A. Chattock (Bradford) were elected vice-presidents; Alderman G. Pearson was re-elected hon. solicitor, and Mr. J. H. Rider hon. treasurer; Mr. J. E. Edgcome (Kingston on-Thames) succeeded Mr. Ruthven Murray in the position of hon. secretary.

The Council for the ensuing year is as follows, new members being marked with an asterisk:—Messrs. Fedden (Sheffield), Taite (Salford), Giles (Blackburn), McCowen (Belfast), Faraday Proctor (Bristol), Christie (Brighton), Kilgour (Cheltenham), *Brydges (Eastbourne), *Talbot (Nottingham), Panton (Bolton), Smith (Barrow), *Mackenzie (Edinburgh), *Dowson (Doncaster), and *Davidson (Harrogate).

The president (Mr. Snell) presented two premiums for papers on continuous current switch gear and fuses, and Mr. J. H. Rider, the hon. treasurer, read his report for 1902-3, from which we gather that the balance in hand amounts to £183. The report was adopted. The annual report of the Council was next presented, and the revised "Emergency Rules" for dealing with cases of live wires falling in the street, came up for final consideration. It is probable that these rules will, in accordance with the expressed wish of the Postmaster-General, be printed and circulated among the P.O. engineering staff.

It was decided to send both the Board of Trade and the Post Office copies of a resolution condemning the use of guard wires, and the Board of Trade subsequently decided that Messrs. W. A. Chamen and A. B. Holmes, representing the Association, should be consulted on the matter.

The Parliamentary Committee of the Association recommended that a Bill placing a limit of an eight-hours day, single shift, on tramways men be opposed; they had also considered among other matters the supply of energy in bulk, restrictions as to above-ground wires, Somerset and District Electric Power Bill, a Tramways Bill clause for the protection of the Postmaster-General, Supply of Electricity Bill, Royal Commission on Municipal Trading, &c.

Among other matters considered by the Council were a suggestion by Mr. T. D. Clothier as to the advantages to be derived from affiliating technical students with the Association; the I.E.E Wiring Rules, Mr. Ruthven Murray and Mr. Faraday Proctor being appointed to represent the Association upon the I.E.E. Wiring Committee; and the repayments of loans, and loans for wiring and motors, &c.

The President, in moving the adoption of the report, added a resolution that only members of the Association and guests, who may be officially invited, be eligible to attend future Conventions, giving as a reason the growing burden which they placed upon those who entertained them during the meetings.

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## ELECTRICAL WORK IN AUSTRALIA.

THE following are extracts from the presidential address delivered to the Electrical Association of New South Wales, at Sydney, on April 3rd, by the President, Mr. J. R. W. Gardam:—

The Association may well congratulate itself on being now so firmly established that, through all the early trials of the industry in Australia, it has reached its twelfth year and has developed from promising childhood to ripe manhood in a way that augurs well for its future. Our ranks are being rapidly enlarged by the acquisition of many new members, principally of the younger electrical generation, who, unhampered by the older theories and practice, can probably approach the present state of the science with even more confidence; having the advantage of clearer and more lucid definitions of electric phenomena than the older generation, who 15 or 20 years ago were without the information now so readily at hand.

In the theoretical world, the remarkable discoveries relating to that complicated phenomenon, known as radio-activity, have exercised to a large degree the attentions of the most noted physicists. The rays emitted by the substances uranium, thorium

and radium seem inexhaustible, whilst those of the latter two are extraordinarily penetrating. Whatever may be the true explanations of these mysteries, whether attributable to the existence of electrons in the free state or not, they may affect very materially the future of the human race.

Here, in Sydney, we are proud of our electric tram system—a system ranking among the biggest on earth, one that has a mileage equal to that of Glasgow, though the population is less than one-half, and that population is carried 240 times in the year, as against 155 times in Glasgow; this is not due to cheaper fares, for the ½d. fare is in use in Glasgow. The steam tram is now in its last days, and the department has done wonders in converting the entire system to electric in so short a time and so effectively. Why the present cost of 12½d. per car-mile is so high I am at a loss to understand, as the average at home is somewhere about 7d., and never higher than 10d., even when power is purchased outside. It may be accounted for by the Commissioners having foisted on them pioneer lines, and having to pay luxurious rates to their men. That the change and extension of the system have given satisfaction, together with the adoption of 1d. fares, is shown by the fact that over 60 per cent. more passengers were carried in 1902 than in 1900.

We have reason to think that we are going to be proud of our lighting when the Council's public supply is available; not that I discount the work that has been done by the private supply companies, as, had it not been for them, electricity in Sydney would still be practically unknown, and the Council would have to start building up a demand, with as great an uphill fight and the same disappointments as these companies have successfully overcome.

The Municipal Council of Sydney, in as short a time as six years after obtaining Parliamentary sanction, decided that tenders should be called for the work. Messrs. Preece & Cardew have drawn up a scheme admirably suited to the requirements of this city, and during the past year tenders have been accepted for the greater part of the initial plant, mains, &c. The scheme will consist of two 600-KW. and one 300-KW. sets generating three-phase current at a pressure of 5,200 volts between conductors, with a periodicity of 50 cycles per second. This current will then be taken to seven sub-stations, to be there converted down to a pressure suitable for distribution. In the city area two sub-stations will contain motor-generators which will convert the high-pressure three-phase current to continuous current for feeding a three-wire network with 480 volts between the outers, and with the middle wire earthed. The other sub-stations will contain static transformers having their primary coils mesh-connected, and the secondaries star-connected, with the neutral earthed; a four-wire distributing network, having 240 volts between the neutral and each outer, will be fed by these transformers. The size of plant proposed seems very inadequate for the large area it will supply, as, after providing for the street lighting and their own requirements, they will have but 1,000 KW. for other uses, whereas the five city lighting companies have in use 1,820 KW. to supply only a limited portion of the city; but, as a system, it is one capable of such extension as would embrace all the suburbs.

A difficult problem which the Council has to face is, how shall it deal with the existing companies? That it will not adopt arbitrary measures is certain, for it cannot be denied that, by its continued delay in giving the undoubted demand of the citizens an electric supply, it encouraged the growth of these private concerns, and such supply, when once started, cannot stand still, as the companies' histories show that year by year they were forced to put down additional plant to meet the incessant increases; until now, in the city proper, counting only the five principal stations, they have expended a capital of over £130,000.

One of the chief benefits to be derived from the Council's supply is that the streets of Sydney will be transformed from being the worst lighted in the world, a disgrace to any civilised town, wherein it is positively unsafe to walk at night, to the most modernly and effectively lighted.

Though the misguided and unenlightened being thinks he is showing the broadness of his views, and that he is no jingo, by buying foreign material, and, in fact, gives advantage to the foreign article over the British-made goods, it is highly gratifying to note that the City Council by their choice of plant, &c., will not only have obtained a plant at a lower cost, but, as time will prove, one more efficient and lasting than they would have had, had they bought it outside this empire. Can anyone in this room give any reason why, other things being equal, we should assist foreign labour, and particularly those countries which by their prohibitive tariffs absolutely prevent the competition and importation into their own countries of British-made goods? Is it any reason that because the wool and produce of this country finds its way into European markets, because they cannot buy a sufficient quantity elsewhere at a lower figure, we should reciprocate by purchasing machinery from them which we can ourselves turn out as well, if not better, than they?

I have been approving of the tramways as a system, but cannot refrain from saying that that huge mass of foreign material running at Ultimo and along our streets is indeed a reflection on our Government and its advisers. It appals one to know that in a British country British firms were not even asked to tender for the last large expenditure on the generating plant, and for this State's sake, I trust the engines, which are similar to those which, alongside the Musgrave engines at Glasgow, cut so poor a figure, will give better results here. By the good sense of the Council an indication is given that the scare and oft-repeated mis-statement implying British decadence is being corrected. It may be admitted that, owing to the necessarily conservative laws of the older countries, we have been left a little behind in some small matters, but I have yet to learn that England cannot turn out engines, above all things, superior to those built anywhere else.

Soon we can hope that the low level electric sewerage scheme will be in full working order. A paper read before this Association by one of its members gave a very clear description of the methods being adopted, and it is only to be regretted that at the time the scheme was thought out no early anticipation of high-pressure current being available in the city could be seen. Had such possibility been known, the capital cost of the system would have been very considerably diminished.

Of other electrical work in Sydney, the lighting companies have been increasing in a wonderful manner. In one instance the output was 45 per cent. greater in 1902 than in the previous 12 months. I estimate that, without counting Government or Council work, no less than 2½ million units were used for private lighting and power last year, all supplied by the city companies, whilst the connection reduced to 8 C.P. equivalents was over 100,000. The Municipal Council of Redfern during the past year introduced an all-day supply, anticipating a good motor load, and though at the present time a difficulty arises in getting locally satisfactory motors to work on their single-phase current, I have no doubt that in a short time the load that will be acquired will be a valuable addition to their revenue.

Motive power is rapidly becoming as important a load for central stations as lighting is; the growth of the demand, especially during the past two years, for small motors, is such that now in the city the kilowatt-capacity is more than 30 per cent. of the total connections, and nearly all these motors are of small size, up to 5 H.P. Although not many of the machines driven by motors are built for direct coupling, motors have been attached to almost every variety of work requiring power, and by their many superiorities over other motive powers are gaining daily in favour. One interesting case I am acquainted with is the driving of a quadruple press at the *Sydney Morning Herald* Office, with a motor of 50 H.P. directly connected. The press prints an eight-page edition, complete, at a rate of 48,000 per hour. The system of driving is that known as the Bullock Teaser system. The system seems to be very economical, as the consumption of current is under one unit per 750 complete copies.

Turning to the question of the "Nernst" lamp, the president thought that in their present state the small "Nernsts" have no field, but the larger ones can be used with very good effect in place of high candle-power glow lamps or small arc lamps.

After a reference to the Cooper-Hewitt mercury vapour lamp, he touched upon electric lifts, which are beginning to get a footing in Sydney at last. He anticipated that it was only a matter of a few years when the majority of lifts would be electrically driven, as the running cost of those already installed fully bore out the published results in other countries. It was stated that the biggest firm of lift builders, making both hydraulic and electric, were now building ten electric for each one hydraulic. At the G.P.O. the electric lift had been working for 3½ years without a single stoppage or a single repair, and the official figures gave the cost of running as less than one-fourth of what it previously cost for hydraulic power. Messrs. W. S. Friend & Co. carried up over 5,000 tons of merchandise for £3 10s., and a second elevator had been put in on account of the satisfactory operation of the first. Messrs. David Jones & Co.'s lift carried 119,000 people at a cost of £26, or 19 passengers for 1d. A second one had been put in doing similar service to this, and had displaced a hydraulic one that cost £130 a year to run. A dozen others were equally giving every satisfaction.

## WESTINGHOUSE-BREMER ARC LAMPS.

We recently mentioned, in our article on the Poplar electricity works, that a new type of Westinghouse-Bremer arc lamp was in use in the borough. The new lamp is shown complete in fig. 1, while fig. 2 shows the mechanism, and fig. 3 is a diagram of connections, by the aid of which the mechanism can be readily understood. Four solenoids are used: the two striker, or lighting coils, the shunt coil, and the arc-controlling coil. The first two are connected across the lamp terminals, and are in series with the substitutional resistance, as well as a small relay, which magnetises or demagnetises the coils. The two plungers moving in the coils are coupled to a link-and-lever motion, which (1) releases or grips the carbons; (2) revolves the magazine to bring up the next pair of carbons; (3) moves in the striker plate to start the arc. The second coil is a shunt to the arc and is always in circuit, but the strength of its field varies with the resistance of the arc. It serves to attract an armature, which acts as a switch to short-circuit the blow coil (described later). This armature is released when the arc is normal, but is at once attracted when the arc fails or lengthens. The third coil exerts its influence on the arc, repelling it from the points, and producing a long flame. It is always in series with the arc, but is short-circuited when the shunt relay is actuated and so releases an armature, which in falling closes a switch, completing the circuit of the striker coils. This relay can be seen in fig. 2, the blow coil being in front of the lamp. When the lamp is burning the striker coils are inactive, the shunt coil is energised, but is not sufficiently powerful to attract its armature, and the blow coil in series with the arc is also active, holding up the relay in the striker coil circuit. As the arc lengthens and the shunt coil becomes strong enough to raise the relay the blow coil is short-circuited, and in turn releases its armature and cuts in the striker coils. These at once exert a pull on the mechanism which lowers the carbons, swings round the striker plate, and readjusts the arc. A slight blink only

is caused by reason of the passage of the striker under the carbon points.

The arc proper is surrounded by a copper hood or cup, which acts as a reflector when the white ash and fine mineral particles released by the arc are deposited on it. A number of these particles in an incandescent state are also suspended in the atmosphere around the arc, and tend to further increase the intensity of the illumination.

FIG 1.

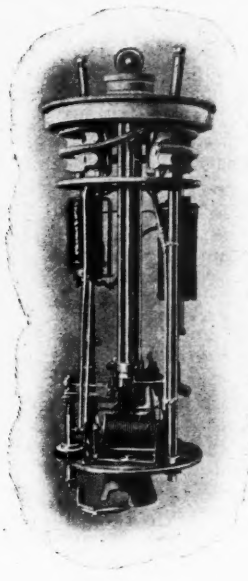

FIG. 2.

A special feature of this latest type of lamp is the magazine, which holds five pairs of carbons, and increases the burning life to 40 hours. The position of the carbons also simplifies the trimming, to effect which two caps are removed at the top of the hood, and the pencils are dropped into their respective tubes, when the caps are replaced. The caps are distinctly marked to minimise errors with the carbons, and each cap has a chain attached to ensure its

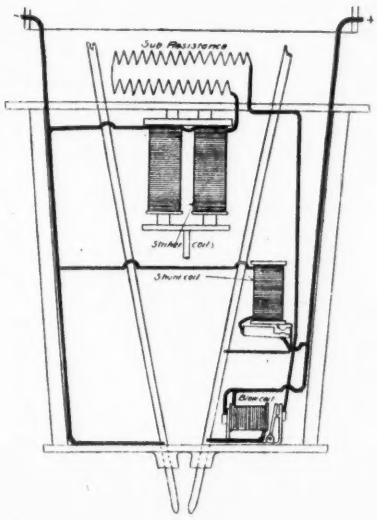


FIG. 3.

return over the correct magazine. An ingenious method of automatically inserting the next pair of carbons is employed, and the old ends drop clear to the bottom of the globe without obstructing any of the moving parts. Tests on the lamp are said to give the following results:—

| | With globe. | Without globe. |
|---|---|---|
| Maximum candle-power ... ... | 2,400 | 5,500 |
| Mean hemispherical candle-power | 1,500 | 5,000 |
| Watts per maximum candle-power | 0·18 | 0 081 |
| Watts per mean hemispherical candle-power ... ... ... | 0·289 | 0·133 |

As the maximum theoretical candle-power obtainable from incandescent bodies, the whole of the radiation from which is in the form of light, is about six candles per watt, or at the rate of ·17 watt per candle, it would seem that the reflector mentioned above has a very high efficiency.

At present lamps for use on direct current only have been made; but an alternate current form will be produced at an early date to emit light of a similar character The direct-current lamps are made in sizes from 5 to 9 amperes, for burning either 40 hours or 12 hours. Special carbons are supplied for use with the lamp, and only this kind must be employed, to obtain the best results.

The important features of the Westinghouse-Bremer lamp may be summarised as follows:—High efficiency, even distribution of light and illumination of globe, absence of glare, and great penetrative power, especially in fogs. In addition, the mechanism is simple, there are no protruding rods below the arc, and the entire lamp is exceedingly compact, being much smaller than the old Bremer lamp.

A large number of these lamps are already in use at Poplar, Nuneaton, Shipley, Ilfracombe, and other places, for street lighting purposes, while many more are on order for the most important electric supply undertakings in the country.

## THE CONTINENTAL ELECTRICAL ENGINEERING INDUSTRY.

### THE QUESTION OF COMMERCIAL TREATIES STILL ABSORBING ATTENTION.

THE Association for the Protection of the Economic Interests of the German Electrical Engineering Industry held its annual assembly recently at Mannheim, under the presidency of Herr A. Haeffner, of Frankfort-on-the-Maine. In the course of the report submitted to the meeting reference was made to the work of the Association during the year, including an agitation against the proposed new duties on raw lead and copper, the preparation of memorials in regard to new treaties of commerce, the regular presentation of information concerning opportunities of doing business in other countries, and other matters.

A resolution was eventually adopted unanimously by the assembly emphasising that the German electrical industry does not require special protection in the home market, but that the greatest value is attached to foreign markets being kept open, and not closed by high import duties. The Association regards the new tariffs projected by Russia, Austria-Hungary and Switzerland as prohibitive for German electrical productions, and it would, therefore, see greater advantage in an extension of the existing commercial treaties than in the conclusion of new ones on the basis of the high import duties contemplated by the tariffs in question. It does not appear from the brief official report of the proceedings that the conference discussed the question of the suggested British Zollverein, but it is improbable that this was done in view of the indefinite position of the scheme at the present time.

The formation has taken place at Hanover of Körting Bros. and Co. for the purpose of acquiring the business of the firm of Körting Bros., who have branches in other parts of Germany and in other countries. The capital of the company is £800,000, with a proposal to issue £225,000 in bonds, and a noteworthy portion of the capital has been taken up by the Allgemeine Elektricitäts Gesellschaft and the Berlin Handels Gesellschaft. The electrical department of the Hanover firm has been separated from the new company, and has either been absorbed by the Allgemeine Co., or converted into an independent enterprise.

#### GERMAN ENTERPRISES.

The directors of the Felten & Guilleaume Co., of Mulheim-on-the-Rhine, whose general meeting for the past financial year has just taken place, had the satisfaction of presenting a more favourable balance-sheet to the shareholders than that of a year ago. In 1900 the net profits amounted to nearly £340,000, and a dividend at the rate of 10 per cent. was paid, but although the net results for 1901 were represented by over £88,000 it was decided to transfer £50,000 of that sum to a special reserve fund and to abstain from making any distribution among the shareholders. The accounts for 1902, after writing off £44,600 for depreciation as against £42,550, and placing £4,950 to the legal reserve fund as compared with £17,880, show net profits amounting to £122,153. This sum allows of the payment of a dividend at the rate of 5 per cent. for the year, with a carry-forward exceeding £14,500.

The report for 1902 of the Mix & Genest Telephone and Telegraph Works Co., of Berlin, records a diminution in the total turnover owing to the Government orders being less than in the preceding 12 months, and the financial results have consequently been of a less favourable nature. As far as the company's independent branch establishments are concerned, the report mentions that those at Cologne and Hamburg worked entirely satisfactorily, whilst that in London was subject to the influence of the unfavourable situation of business in England. After providing £9,372 for depreciation as against £9,186 in 1901, the accounts show net profits amounting to £9,897 as compared with £21,551, and a dividend at the rate of 4 per cent. has been declared as against 9 per cent. in 1901. In the course of observations made at the recent general meeting, Herr Genest stated that the transactions with the Post Office authorities considerably improved during the last three months of the year, and that further consideration to the company had also been shown in the new year. As far as the heavy current department was concerned, it was admitted that it was the sick child of the company. It had been worked at a loss; but even if that particular department had to be abandoned, it would not be

any danger to the company. The latter had, as well as other enterprises, sought to improve prices of heavy goods during the year, and at present operations in that particular branch had been restricted in order to reduce expenses. With regard to the current year, Herr Genest said that he entertained the hope that it would yield a more satisfactory dividend than the past, and he mentioned that the sales during the first four months had reached an unprecedented height, although this circumstance did not allow of any conclusion being drawn as to the total results for the year, as prices were lower than in former years.

The North German Marine Cable Works Co., of Nordenham, may be mentioned as being closely associated with the German Atlantic Telegraph Co., which, in fact, holds slightly over one-half of the former's total share capital of £300,000. An increase in the capital of the North German Co. from £100,000 to £300,000, which took place two years ago, allowed of an extension of the cable factory and the commencement of the manufacture of the second cable for the German Atlantic Co. At the end of 1902, 1,116 miles of the cable had been completed, and in May of this year the length had been increased to 1,860 miles. The company's report mentions that, apart from this cable, the factory turned out smaller orders, including a three-core cable laid from the mouth of the Weser to Wangeroog. The cable steamer *Podbielski* was engaged for 144 days during 1902 on repairing cables and taking soundings for the route of the second cable to be laid across the Atlantic. A second cable steamer for this purpose was ordered from the Stettin Vulcan Co., which had recently completed the delivery of the vessel. The accounts show that manufacturing operations realised a gross profit of £40,681 as against £23,686, and laying and repairs produced £4,464 as compared with £13,836. After writing off £22,457 for depreciation as against £10,754, and providing for other items, there remains a balance of £2,226 to be carried forward, and thus no distribution is made for 1902 as in the previous year. The report states that there is prospect of the company receiving further orders for cables in the next two years before the completion of the existing large contract for the second cable across the Atlantic.

The Electra Co., of Dresden, which has a share capital of £225,000, is interested in various electric tramways and electricity works, of which some are worked by the company's own staff. During the year 1902-1903, the operating results of the tramways were detrimentally affected by the unfavourable weather, and the sale of the Mulhouse electricity works terminated the income of £3,500 hitherto received from that source, although these losses were almost entirely compensated by economies realised and by the development of the other undertakings in which the company is interested. The net profits amount to £4,923 as compared with £5,594, and a dividend at the rate of 1 per cent. has been declared, this being the same rate as in the preceding year.

### French and other Companies.

Among French companies may be mentioned the Compagnie Continentale Edison, which earned a net profit of nearly £42,000 in 1902, and has distributed £24,000 by way of dividend at the rate of 8 per cent. on the ordinary shares. The Société Le Triphasé has resolved to pay 4 per cent. on the ordinary capital, whilst the Compagnie Generale de Traction is unable to propose any distribution. The latter has undergone drastic reforms during the past year, including a reduction in the share capital from £1,200,000 to £424,000, and although the deficit in 1901 exceeded £800,000, there still remains a debit balance of £136,000.

The Austrian Union Electricity Co., of Vienna, which increased its share capital from 3,000,000 kronen to 5,000,000 kronen during 1902, has had a most unsatisfactory year. As its name denotes, the company is an offspring of its German namesake, which is still largely interested in the undertaking. A year ago the Austrian company was able to declare a dividend of 4 per cent. for 1901, but the past year's trading has resulted in a loss of over 658,000 kronen, and after absorbing the reserve fund the debit balance to be carried forward still amounts to 641,000 kronen. The company has hitherto had to meet, among others, the competition of the Berlin Allgemeine Co., which has no branch establishment in Austria. In view, however, of the community of interests now existing between the Allgemeine Co. and the Union Co., of Berlin, it is proposed to make arrangements to extend the understanding in some way so as to avoid any rivalry between the Allgemeine Co. and the Austrian Union Co. in the future.

The Roumanian Electrica (Lahmeyer) Co., which is a subsidiary of the Frankfort Lahmeyer Co., represents its German parent in Roumania, Servia and Bulgaria, and at the same time works the stations built in Roumania, by the Frankfort company. It has a share capital of £100,000, and as the net profits for 1902 amount to £5,420, it is proposed to pay a dividend at the rate of 4 per cent. for the year.

The Russian Tudor Accumulator Co., of St. Petersburg, proposes to distribute 6 per cent. for 1902, as against nil in 1901, and 3 per cent. in 1900.

## PROGRESS IN ALTERNATING CURRENT MOTORS.

In the *Western Electrician* for May 2nd, 1903, are described two recent inventions for improvements in induction motors which are worthy of notice.

The first relates to a method of improving the starting torque without the insertion or use of any high specific resistance material in the rotor circuits, and is due to Abe Lincoln Cushman, of Concord, N.H. The object is attained by dividing the winding into a number of elements all of low specific resistance material, such as copper, which may be entirely separate, or may be connected star or delta fashion, so long as they can be brought into action gradually or successively. When in star connection, as shown in fig. 1, they are connected into a number of star-connected parallel closed circuits when at full speed, while, when starting, there is but a single star-connected winding. This results in a reduction of the current in the rotor at start, and improves the starting torque. Fig. 1 represents a star winding for an eight-pole induction motor embodying the invention.

The second invention relates to the variation of the speed of induction motors by varying the number of poles, and is due to Robert Dahlander and Karl Arvid Lindström, of Westeras, Sweden. The invention deals with that class of drum windings for alternating current motors in which the conductors are so arranged that, by simply varying the coupling of the same, the number of poles, and consequently the speed of the motor, may be altered. In the winding which they have devised, the conductors are so arranged that each two adjacent conductors, or groups of conductors, of one phase embrace one of the conductors or groups of conductors of each of the other phases. The winding, in fact, is so arranged that the conductors or groups of conductors for the several phases follow each other in regular progression around the member on which they are wound. The conductors are connected to form separate windings for the several phases, and the winding for each phase is divided into two sections, with the two terminal connections so arranged that the windings may be connected either in such manner that the current will flow in the same direction through both sections of each winding, or so that the current in one of the sections will be reversed.

Fig. 2 represents diagrammatically a drum winding for a three-phase motor with the windings so connected as to produce a field having 16 poles. With the terminal connections arranged as shown, the windings for the three phases are connected together at one end, and at the other end are connected each to one of the three-phase mains, the three middle terminals being left on open circuit. This connection gives 16 poles, as indicated by the letters N, S. By making use of the middle terminals it is possible, however, to reverse the direction of the current in one of the sections of each of the three windings, and with the conductors arranged as shown in the diagram this will produce a field having only eight poles.

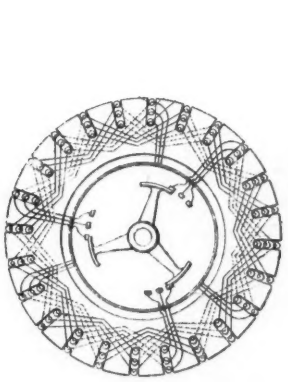

Fig. 1.

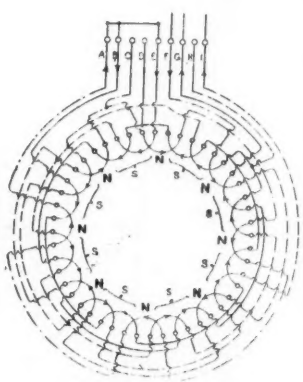

Fig. 2.

We should welcome reliable tests of the Cushman motor. It seems probable that a rotor of this type, together with the latest improvement in stators, should produce a very good induction motor. The invention described, being an improvement in the rotor, can be adapted to induction motors of any number of phases, hence its value.

Although the Dahlander and Lindström invention possesses the merits of a simple method of halving the number of poles, it is not likely to give much impetus to the further adoption of induction motors. The speed of induction motors varies inversely as the number of poles, and although a motor capable of running at two widely different speeds

will have a more extensive application than one which can only run at one speed, we cannot expect a more general adoption of alternating motors until a gradual variation of speed is obtained.

The idea of varying the number of poles is, of course, not new. It is only the particular method of accomplishing this that is novel in the invention.

## THE DEVELOPMENT OF THE CURRENT INTERRUPTER.

By J. WRIGHT.

(*Continued from page* 128.)

A curious phenomenon noticed in connection with the working of the Caldwell interrupter is that after a while the level of the liquid on one side of the partition will be found to have risen, whilst that on the other has fallen by a corresponding amount. Moreover, this effect is not dependent upon the direction of the current through the apparatus, as may readily be proved by reversing the polarity. Dr. F. T. Trouton's explanation of this phenomenon is that the bubble of vapour, formed at each interruption, will the more readily locate itself on that side of the opening where the pressure is lowest, viz., towards the side of lowest level. Since this bubble is bordered by liquid on either side, it is obvious that the minute quantity of electrolyte in the opening will be greater on the opposite side, or region of highest level; consequently the bubble, in exploding, drives this greater volume back into that side of the vessel, and the whole mass, flowing together again at the centre of the opening, is ready for a repetition of the cycle. The quantity of liquid in that half of the vessel having the higher level is therefore increased at each interruption by an amount equal to the displacement of the vapour bubble from the centre of the opening. The rise in level increases up to a certain point, at which arcing at the point of break ceases, and the electrolyte flows back through the opening from the higher to the lower level until the original action is re-established.

An electrolytic interrupter, based upon the original productions of Wehnelt and Caldwell, has been devised by Mr. A. A. Campbell Swinton, in co-operation with Messrs. J. Stanton and H. Wolff, a description of which was published by the former gentleman in 1899.* It consists, fig. 13, of an outer containing vessel V, preferably of glass, provided with a lid L, which supports the remaining portions of the apparatus. T is a tube of glass or porcelain, depending from the centre of the lid, and forming with the central stem S, which may also be of glass or porcelain, a regulating valve for the electrolyte. The stem S is provided at its upper extremity with a screw thread and milled nut N, by means of which it can be raised or lowered in the fixed

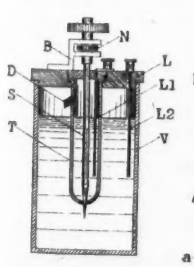


Fig. 13.

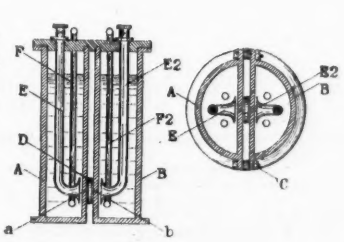


Fig. 14.

bracket B. Its lower end is taper, and passes through the circular opening in the tube T, some 3 or 4 millimetres in diameter. D is an outlet from the tube T, which allows the electrolyte to flow back into the main vessel V as its level rises in T, whilst $L_1$, $L_2$, are lead plates, forming the two electrodes of the device, immersed respectively in the electrolyte in T and V; they are electrically connected with terminals on the lid, as shown. The taper on the lower end of S should be fairly long, in order to compensate for a certain amount of erosion which takes place at the point of interruption. A large range of adjustment is claimed for this device, whilst the alteration in level of the electrolyte during work, which has already been alluded to in connection with the Caldwell interrupter pure and simple, is compensated for by the overflow outlet D.

A compact and portable form of electrolytic interrupter was devised by Prof. Elihu Thomson and Mr. Robt. Shand. It is concentric in form, and consists of a heavy copper wire some 6 or 8 in. in length, tipped at one extremity with a short length of platinum wire of smaller gauge, which constitutes the anode, the other extremity of the copper being provided with a suitable terminal for connection to external apparatus. Immediately surrounding the copper wire as an axis is an insulating sheath of hard rubber or ebonite, which, again, is surrounded by a tube of lead, forming the cathode, to which a terminal attachment is secured for purposes of connection. A system of screwed flanges at the upper extremity of the cylinder provides a means of adjusting the extent of projection of the platinum anode from its insulating sheath, and consequently of the current passing. The device is rendered complete by immersion in any suitable vessel containing dilute sulphuric acid of the usual strength.

As pointed out by M. Bary, there are three phases in connection with the working of the Wehnelt interrupter. At a comparatively low E.M.F. simple electrolysis is set up, oxygen being evolved at one pole and hydrogen at the other. As the E.M.F. rises, the apparatus commences to act as an interrupter, while with a still higher E.M.F. the interruptions cease, and the platinum anode becomes red-hot, being surrounded, as has been proved, by a layer of heated vapour. This latter phase is a direct sequence of the first or electrolysis stage if no inductance be included in the circuit. J. Carpentier has demonstrated the possibility of obtaining the interrupter phase for lower E.M.F.'s than was previously deemed possible, having achieved this result by raising the temperature of the electrolyte artificially. It can then be worked at a lower E.M.F. than the normal 25 to 30 volts, owing to the heat produced in action, always provided that suitable steps be taken to prevent a too rapid radiation and consequent cooling below the workable limit.

According to Mr. W. J. Humphreys, the electrolyte in a liquid interrupter may be varied at will within certain limits. Speaking approximately, the efficiency of the liquid as an accessory to the interrupter increases in direct proportion to its electrical conductivity. Many solutions have been tried, and that of sal-ammoniac or chloride of ammonium has been found to yield the most rapid break of all, though its adoption for the purpose unfortunately gives rise to the formation of tri-chloride of nitrogen, a high explosive, which renders the interrupter charged with it somewhat dangerous.

Lagrange has succeeded in reversing the action of the Wehnelt interrupter, or, in other words, producing the actual energy of interruption at the cathode instead of the anode, thereby enabling much larger currents to be dealt with than is possible with the ordinary form. For this purpose he constructs his cathode of a series of copper rods, which are metallically connected with a large sheet of the same metal, situated outside the liquid and acting in the capacity of a radiator. Another form of radiator consists of a copper containing vessel, through which a continual stream of cold water is caused to circulate. With this form of apparatus its inventor has succeeded in interrupting currents of 100 amperes, and, moreover, in the absence of any inductance in the circuit.

H. T. Simon has brought out several modified forms of the electrolytic interrupter, the general arrangement of which he has patented. One type consists of a lead containing vessel filled with dilute sulphuric acid, in which is immersed, depending from the ebonite lid, an ordinary test tube containing a cylinder of lead. The bottom of the test tube is perforated by several openings, about 1 millimetre in diameter, through which the interruptions take place. The outer vessel and the inner lead cylinder are the electrodes of this apparatus. Another form consists of two separate vessels filled with the electrolyte, in which are respectively immersed two identical electrodes; an inverted U-tube,

* Letter to the *Electrician*, June 30th, 1899.

filled with the electrolyte, connects the two, the necessary interval in the liquid column being provided by a bubble at the bend of the U. The apparatus is said to work equally well with continuous and alternating currents, and to be unaffected by the heat developed in action.

Ruhmer's improvement upon the Simon-Caldwell form of interrupter with multi-perforated diaphragm, is represented in fig. 14, and was designed with a view to obviating the disadvantages attendant upon the erosion or wearing-out of the diaphragm. The latter, shown at D, is interchangeable and consists of perforated porcelain; it is placed between the two plane walls of the semi-cylinders, A, B, which are bolted together at C; E, $E_2$ are the lead electrodes, flattened out at their lower extremities, as shown, such that they almost cover the two openings, *a* and *b*, in the plane sides of the semi-cylinders. The diaphragm, D, is placed immediately in the track of these openings, and forms the base, or *locale* of the interruptions; F, $F_2$ are circulatory pipes for the passage of a stream of cold water, which serves to keep down the temperature. In a later improvement on this device, the electrodes are introduced through the semi-cylindric walls of the two compartments, A and B, at a point in line with the openings *a*, *b*, and, further, by making one electrode of lead, and the other of aluminium, Ruhmer has succeeded in interrupting an alternating current in one direction only, a point of great utility in X-ray practice. When used for this purpose, the useful life of the aluminium electrode is some 500 hours.

(*To be continued.*)

## NEW PATENTS APPLIED FOR, 1903.

**Compiled expressly for this journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.**

18,637A (1902). "A new or improved electric post, being a method of and means for the collection, transmission and distribution of letters, parcels and the like." R. T. PISCICELLI. July 15th. (Date applied for under Patents Rule 9, August 25th, 1902.) (Complete.)

15,438. "The self-acting adjusting fork for the trolleys of electric tramcars, or other vehicles or engines to which it may be applicable." C. GANDY. July 13th.

15,479. "Improvements in regulating systems of electric distribution." P. M. JUSTICE. (The National Battery Co., United States.) July 13th. (Complete.)

15,480. "Improvements in regulating systems of electric distribution." P. M. JUSTICE. (The National Battery Co., United States.) July 13th. (Complete.)

15,481. "Improvements in electric arc lamps." E. R. VIALE. July 13th. (Complete.)

15,494. "Improvements relating to electric insulating material." I. S. MCDOUGALL. July 13th.

15,495. "Improvements relating to electric insulating fabrics." I. S. MCDOUGALL. July 13th.

15,500. "Improvements in alternating-current contact apparatus." THE AKTIEN-GESELLSCHAFT BROWN, BOVERI & CIE. July 13th. (Date applied for under Patents Act, 1901, November 13th, 1902, being date of application in Switzerland.) (Complete.)

15,504. "Improvements in and relating to electric foot-arch supporter." F. B. LEE. July 13th. (Date applied for under Patents Act, 1901, December 30th, 1902, being date of application in United States.) (Complete).

15,506. "Improvements in armatures for electric induction motors." W. P. THOMPSON. (Elektricitäts Gesellschaft Alioth, Switzerland. July 13th. (Complete.)

15,532. "Improvements in dynamo-suspension gear for use in connection with electric lighting systems for railway carriages and the like." THE ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., and R. F. HALL. July 14th. (Complete.)

15,552. "Improvements in apparatus or devices for transmitting and receiving messages by wireless telegraphy." C. G. BURKE. July 14th. (Complete.)

15,562. "Improvements in telephone exchange systems." W. AITKEN. July 14th.

15,569. "An improved method of, and apparatus for, wireless signalling, chiefly designed for determining the nautical bearing of navigable vessels." H. W. LADD. July 14th. (Complete.)

15,591. "Improvements in means for preventing arcing between commutator brushes." E. A. CAROLAN. (The General Electric Co., United States.) July 14th.

15,592. "Improvements in synchronising alternators." E. A. CAROLAN. (The General Electric Co., United States.) July 14th.

15,595. "Improvements in an electric arc lamp hanger and cut-out." E. A. CAROLAN. (The General Electric Co., United States.) July 14th.

15,605. "Improvements in and connected with the wiring of overhead conductors for electric traction systems at terminal stations and the like." W. H. TURNER and W. H. ISHERWOOD. July 14th.

15,623. "Improvements in means for protecting the exposed or live parts of electric switches, cut-outs or the like." W. MCDEVITT. July 14th. (Complete.)

15,636. "New electric contact breakers for sounding alarms when doors and windows are opened." D. S. SEMPLE. July 15th.

15,647. "Improvements in insulated frogs or crossings or the like for overhead trolley wires as used on electric railways." H. BRECKNELL, E. M. MUNRO and H. I. ROGERS. July 15th.

15,682. "Improvements relating to electricity meters." E. BLUMENTHAL and S. SCHLESINGER. July 15th.

15,684. "An improvement in portable electric meters." F. A. DARTON. July 15th.

15,700. "Improved process for reducing organic substances in an electrolytic bath." O. IMRAY. (Farbwerke vormals Meister, Lucius & Brüning, Germany.) July 15th.

15,746. "Improvements in electrical arc lamps." GUEST, KEEN & NETTLEFOLDS, LTD., and W. E. SYMONS. July 16th.

15,767. "Improved means for actuating brakes and retaining same in action, more specially applicable to wheels of cycles, but also adaptable for the purpose of operating valves, switches, or the like." R. VARTY. July 16th.

15,772. "Improvements in and relating to the magnetic separation of ore." W. K. L. DICKSON. July 16th.

15,787. "Improvements in detectors of electrical oscillations." L. H. WALTER. July 17th.

15,793. "A new or improved device for the quick repair of broken trolley wires of electric tramways." T. H. WEBB. July 17th.

15,796. "An improved clockwork or rotary register to be used with or adjusted to any style of electric or gas meters for timing, registering, measuring, &c., electric or gas energy or current." C. DAVIES and C. G. LAWLESS. July 17th.

15,810. "Improvements in electrical fusible cut-outs." C. M. DORMAN, R. A. SMITH and H. G. BAGGS. July 17th. (Complete.)

15,811. "Improvements in dynamo-electric machines for regulating the charge and discharge of storage batteries used in conjunction with train generators." THE LANCASHIRE DYNAMO AND MOTOR CO., LTD., and R. S. MCLEOD. July 17th.

15,816. "The 'Duvolt' contact-breaker screw." P. BAXENDALE and T. F. GAMBLE. July 17th.

15,817. "Improvements in and relating to electrically-actuated musical instruments." W. K. L. DICKSON. July 17th.

15,821. "A magnetic balance or magnetometer and galvanometer." W. HIBBERT. July 17th.

15,831. "Improvements in apparatus for use in welding railway rail joints by electricity." H. F. A. KLEINSCHMIDT. July 17th. (Complete.)

15,834. "Improvements in apparatus for handling and cooling track-welding transformers and welders." H. F. A. KLEINSCHMIDT. July 17th. (Complete.)

15,838. "Improvements in fusible electric cut-outs." K. W. HEDGES. July 17th.

15,911. "An improved method of interlocking electric lamps to their couplings." C. A. SHANKS. July 18th.

15,940. "Improvements in and relating to electric lamps for testing purposes." F. J. GORDON. July 18th.

## PUBLISHED SPECIFICATIONS, 1902.

**Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson and Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).**

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3,751. "Improvements in and relating to electric arc projecting lamps." F. H. Loring. Dated February 13th.

4,271. "Improvements in automatic electric brakes for railway and tramway vehicles." H. H. Lake. (Communicated.) Dated February 19th.

5,057. "Improvements in and connected with telephone transmitters or microphones." H. Oppenheimer. Dated February 28th.

5,296. "Improvements in electric meters." R. Chauvin and R. Arnoux. Dated March 3rd.

18,655. "Automatic switch for electric pumps." R. Collings and A. C. Grisconn. Dated August 25th.

19,652. "Improvements in or connected with ammeters and voltmeters." F. W. Nalder and Nalder Bros. & Thompson, Ltd. Dated September 8th.

20,324. "Improvements in conduits for electric cables." L. Mannstaedt. Dated September 18th.

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22,635. "Antiseptic telephone mouth-pieces." W. M. English and G. H. Burns. Dated October 17th.

23,048. "A winding device for cables to which movable electric apparatus is attached." G. Ackermann and G. Engisch. Dated October 22nd.

23,110. "Improvements in electric projectors with colour-charging devices." A. Engelsmann. Dated October 23rd.

23,661. "An improved electric incandescent lamp socket." K. H. H. Jäger Dated October 29th.

23,969. "Improvements in projectors for alternating current lamps." A. Engelsmann. Dated November 3rd.

24,598. "Improvements in electric furnaces." J. F. Hammond. Dated November 10th.

25,330. "Improvements in system of electrical distribution." J. S. Peck. Dated November 18th.

25,441. "Improvements in electricity meters." C. W. G. Little. Dated November 19th.

25,671. "Improvements in and relating to electric switching arrangements." O. Rennert. Dated November 21st.

25,748. "Improvements in and relating to electric switching arrangements." O. Rennert. Dated November 22nd.

26,477. "Improvements in or relating to rotary current motors connected in cascade system." C. de Kando. Dated December 1st.

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27,472. "An improvement in cooling devices for continuous current dynamo-electric current machines." Siemens Bros. & Co. Dated December 12th.

28,019. "Improvements in electrical switches." Siemens Bros. & Co. and A. S. Clift. Dated December 18th.